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SCIENCE FICTION AND FACT

APRIL 2006

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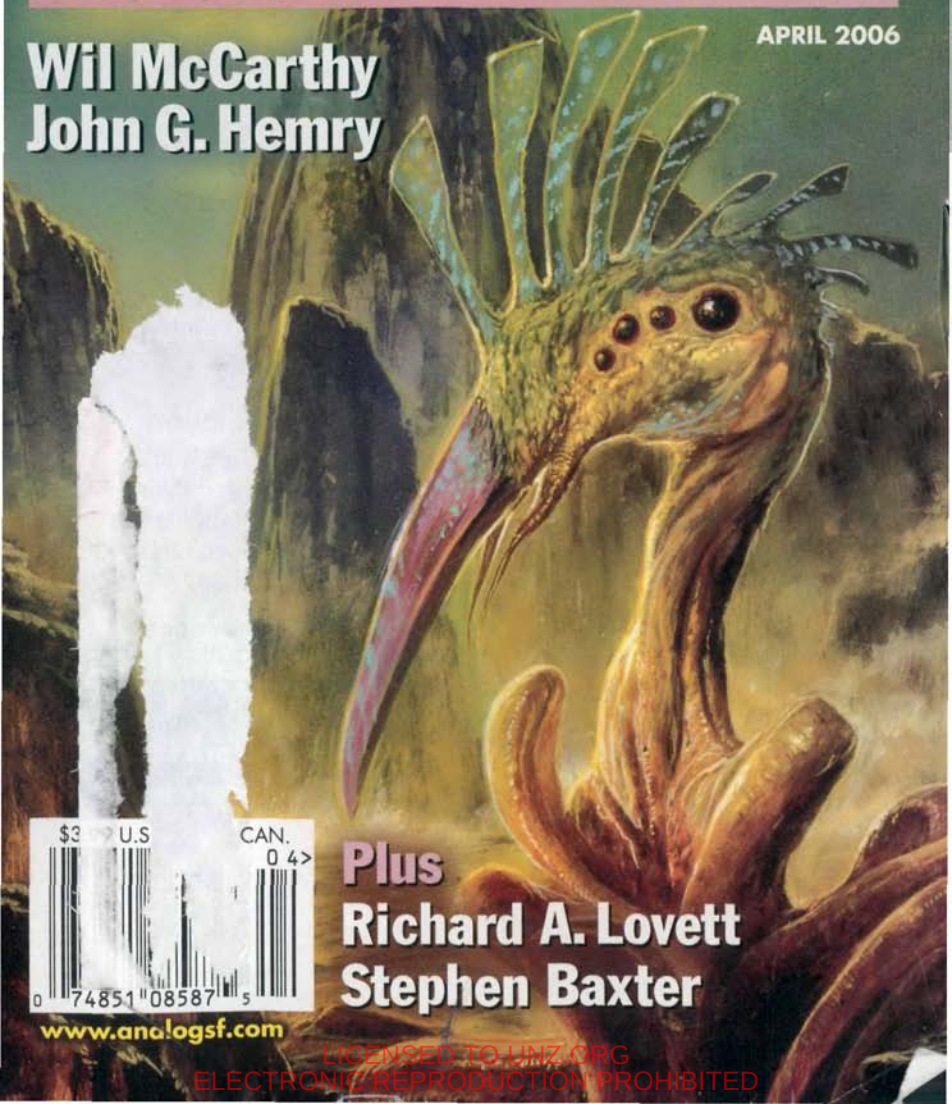
John G. Hemry



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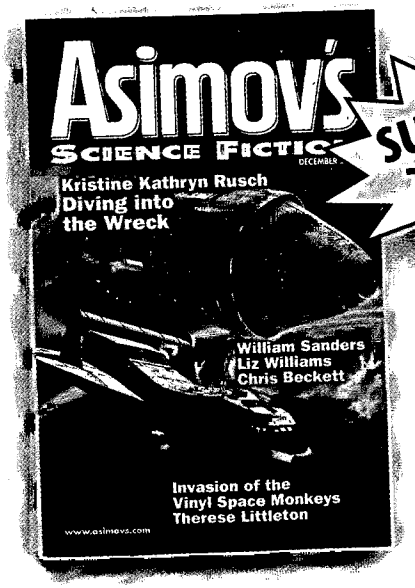

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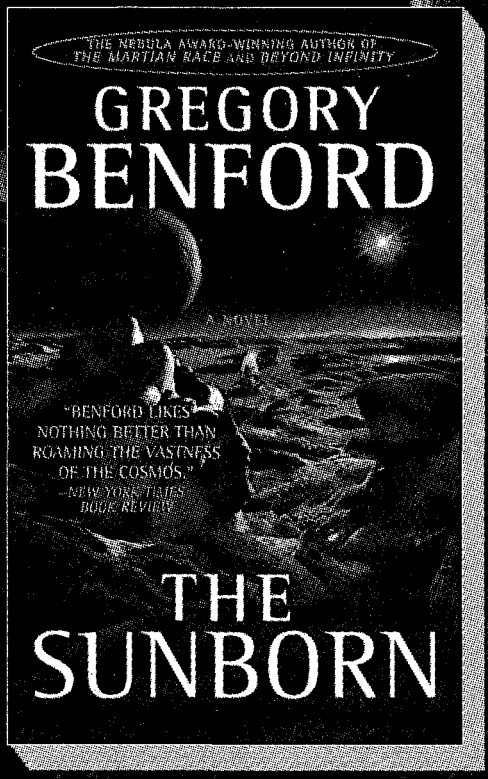
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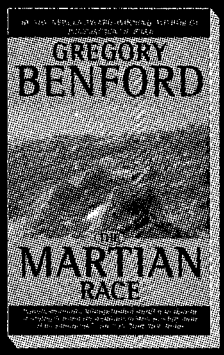

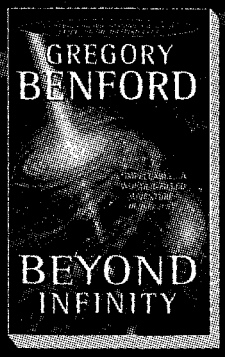

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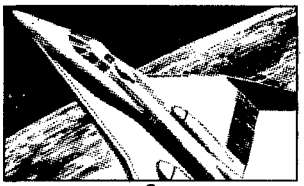

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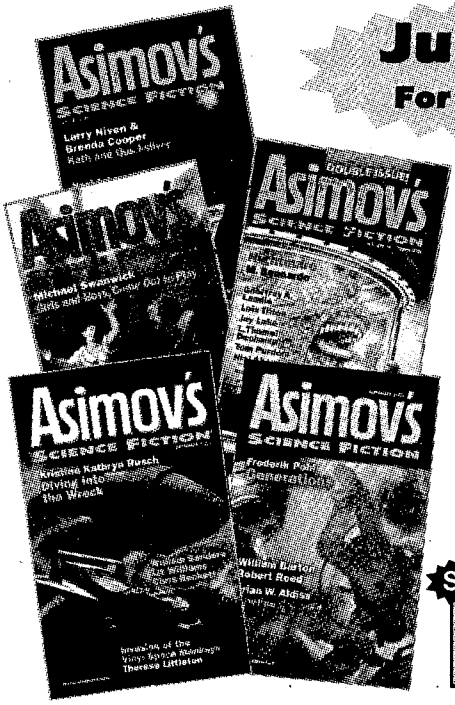

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EDITORIAL Stanley Schmidt

Poison and Hospitality

Sounds like a perverse take on *Tea and Sympathy*, doesn't it? Or maybe a very terse plot abstract of *Arsenic and Old Lace* . . .

Actually, though, it's neither of those things, but rather the result of watching one too many nature documentaries about organisms "surviving" in "inhospitable environments." Or maybe it was the latest science fiction story or speculative essay about the possibility of extraterrestrial life forms somehow living in "atmospheres of poison gases."

The fact is that *nothing* can live long in an atmosphere of poisonous gases, and it makes little sense to describe as "inhospitable" the only environment in which something lives at all. Anything that might live in the dense reducing atmosphere of a planet like Jupiter would be very uncomfortable—to the point of rapid death—in the balmy oxidizing atmosphere we enjoy in temperate parts of Earth. Indeed, such a creature might with equal justification say that *we* live in an atmosphere of poison gases. Polar bears find the polar ice cap the most hospitable place on our planet; it would take a lot of technological assistance to let them thrive in a place like Hawaii, which so many of *us* find so comfortable.

Environments and their inhabitants evolve together, to be well fitted to each other. Words like "poison" and "hospitable" really describe particular kinds of *relationships*, not intrinsic, absolute properties of objects or places. Our language—its structure and the way we are taught to think of it—fools us into thinking of them that way by labeling them "nouns" and "adjectives."

There are, of course, broad limits on the conditions that support "life as we know it"—i.e., life of the kinds found on Earth. But those limits are a lot broader than most of us commonly realize (see, for example, Catherine Shaffer's article in our next issue on "The Terrestrial Search for Extraterrestrial Life"). There are lichens growing in parts of Antarctica where not even penguins can live, and most kinds of penguins live in places where few other warm-blooded animals could survive. There are fish living in springs hot enough to literally cook "normal" fish.

Those extremes, and comparable ones for variables other than temperature, can be taken as the limits of the "hospitable" range for Earthly life, but not necessarily for life that originated and evolved with radically different conditions than any Earth has experienced during life's stay here to date. And it's important to remember that they really define a *range* of ranges, rather than a range hospitable to any single species. Any particular species thrives in a more or less narrow portion of the total range, which it finds the most hospitable of all, and would perish under conditions that somebody else finds "hospitable." Those super-hot-spring fish would quickly perish in a trout stream. *All* fish require conditions that would kill you or me—and vice versa.

It's hard to imagine a more inhos-

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pitable environment *for us* than the ecosystems discovered a few years back around deep-sea vents where sunlight (the basis of surface and shallow-water ecosystems) is completely unavailable and the food chain starts with microorganisms directly metabolizing hydrogen sulfide and minerals in hot water seeping up from below the ocean floor and works up to things like very large worms. It's just as hard to imagine a more inhospitable environment *for them* than the one we inhabit.

These relationship-words masquerading as objective descriptors don't even work the same way for all members of a single species. Some airlines have stopped serving in-flight peanuts and some elementary schools have banned peanut butter sandwiches from students' lunches because while peanuts are a nutritious snack for most of us, they're a deadly poison for the few unfortunate enough to be allergic to them.

Nor are such words restricted to biology. How much blood has been shed through human history exterminating "heathens" or "infidels" because people didn't understand the difference between "you don't believe in what I believe in" and "you're an abomination to be stricken from the universe"? How many generation gaps have been fueled by each of two groups of people with different tastes in music, clothing, or literature fervently believing that their own were "good" and the others' "bad"? How many people have actually believed that a "Best Whatever" award actually meant that in some objective, universal sense? Over and over we see deep rifts and conflicts between human beings arising because they've been conditioned to assume that "adjectives" describe intrinsic properties of things or people rather than subjective relationships between them and people observing them—which may be completely different for different observers, without implying any logical contradiction.

And yet . . .

Sometimes adjectives *do* describe intrinsic, objectively measurable attributes of things, not subject to subjective interpretation. Shortly before writing this, I read a newspaper column that asserted as if it were simple fact that, "The eighties created obnoxiously large hairstyles." That is clearly *not* simple fact; the writer evidently forgot that at least some of the people wearing those hairstyles did *not* find them obnoxious at the time, or they wouldn't have been wearing them—and that *is* simple fact. (He or she also forgot that the same people who eagerly embrace every latest Hot Thing routinely sneer at it a few years later—but that's a subject for another day.) As John W. Campbell observed in an editorial here in December 1963, "Hydrogen isn't cultural"—an observation that H. Beam Piper had still earlier used in his story "Omilingual" (*Astounding*, February 1957), wherein

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the periodic table served as a "Rosetta stone" for the language of an extinct alien culture.

Whether a particular batch of electromagnetic radiation is "visible light" depends on who's trying to see by it. Humans see less than an octave: wavelengths from about 400 to 700 nanometers. For some Earthly insects, "visible light" includes ultraviolet (wavelengths too short for us) but not red. If you ask a human what color a particular light is, most will say "red," but some can't distinguish red and green and neither (nor the very concept of color) means anything to those few humans and some whole species of other animals that see entirely in black and white.

On the other hand, if we agree to define red as "electromagnetic radiation with wavelengths between 6500 and 7000 nanometers," then the answer to whether a particular light meets that definition does *not* depend on who or what is determining it. Anybody who has the right equipment and the know-how to use it will get the same answer, and it means the same thing to all of them. So does the answer to whether a given substance is "transparent" or "opaque" to that light: either it goes through or it doesn't. (In practice, of course, the real answer is often neither yes nor no, because a *fraction* of the light goes through; that fraction may be large or small, which is why scientists and engineers use numbers like absorption coefficients more often than yes-no dichotomies.)

You've probably noticed that most of my examples of words that describe intrinsically, objectively determinable properties are from the physical sciences. Matters biological are more likely to describe properties that are only meaningful in relation to something else: things like "visible" depending on the biological equipment a particular organism uses to see, or "hospitable" or "poisonous" depending on the kinds of conditions to which a particular organism is best adapted. Wishy-washiest of all are human cultural concepts like "well-mannered," "delicious," and "cultured," where at least some of the meanings depend very heavily on cultural context, but are described by words used as if they were intrinsic attributes and universal absolutes.

At least part of the problem is that, so far in our history, our conversation has been almost entirely among humans.

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We've been able to get away with using such words as "comfortable," "visible," and "delicious" as if they described intrinsic characteristics of places and things because most humans are biologically similar enough to agree at least broadly on what sorts of things they perceive in the ways described by those words. "Delicious," however, begins to take us onto shakier ground. Agreement on how food tastes is far from unanimous, partly because of differences in individual biochemistry (even in the same individual from time to time: broccoli used to taste utterly inedible to me, but now I like it) and partly because individual tastes are strongly influenced by cultural conditioning (in some cultures insects are a staple food, while others recoil from the very thought of even trying them).

And that leads us into another part of the problem: a widespread tendency for people to regard as universal absolutes not only things that most *humans* experience in similar ways, but things that are agreed upon only because they are conventions within a particular culture. Some of our wiser minds have recognized that people don't and needn't agree on everything, as when George Bernard Shaw wrote, "Do not do unto others as you would have them do unto you. Their tastes may be different." Unfortunately, some of our more influential (read, better-armed) minds have been unable or unwilling to grasp this concept, and have given us crusades, jihads, and other well-intended atrocities. We will surely have to grow beyond this if we are ever to interact in any mutually beneficial way with nonhuman intelligences.

Meanwhile, we could hardly leave this subject without wondering: are there concepts in human relationships that do lend themselves to more objective definition, that transcend mere individual tastes and cultural biases? I suspect that there are, but it will be a long time before we get many people to agree on them, in part because the list of these more widely applicable moral fundamentals is much shorter than most religions and other philosophies have maintained. I would suggest, for example, that killing others of your kind is bad, period, even if it sometimes becomes necessary in order to avoid some greater badness such as letting them murder you or forcing them to endure a prolonged life of misery that they no longer want: This kind of good-bad or right-wrong distinction, I submit, is far more fundamental and meaningful than the kind that says that it's "wrong" to wear white after Labor Day, eat meat on Friday or pork ever, or use all caps in an e-mail.

Maybe, someday, enough of us will learn to understand that difference to make a difference. ■

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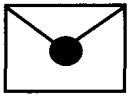

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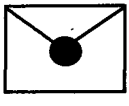

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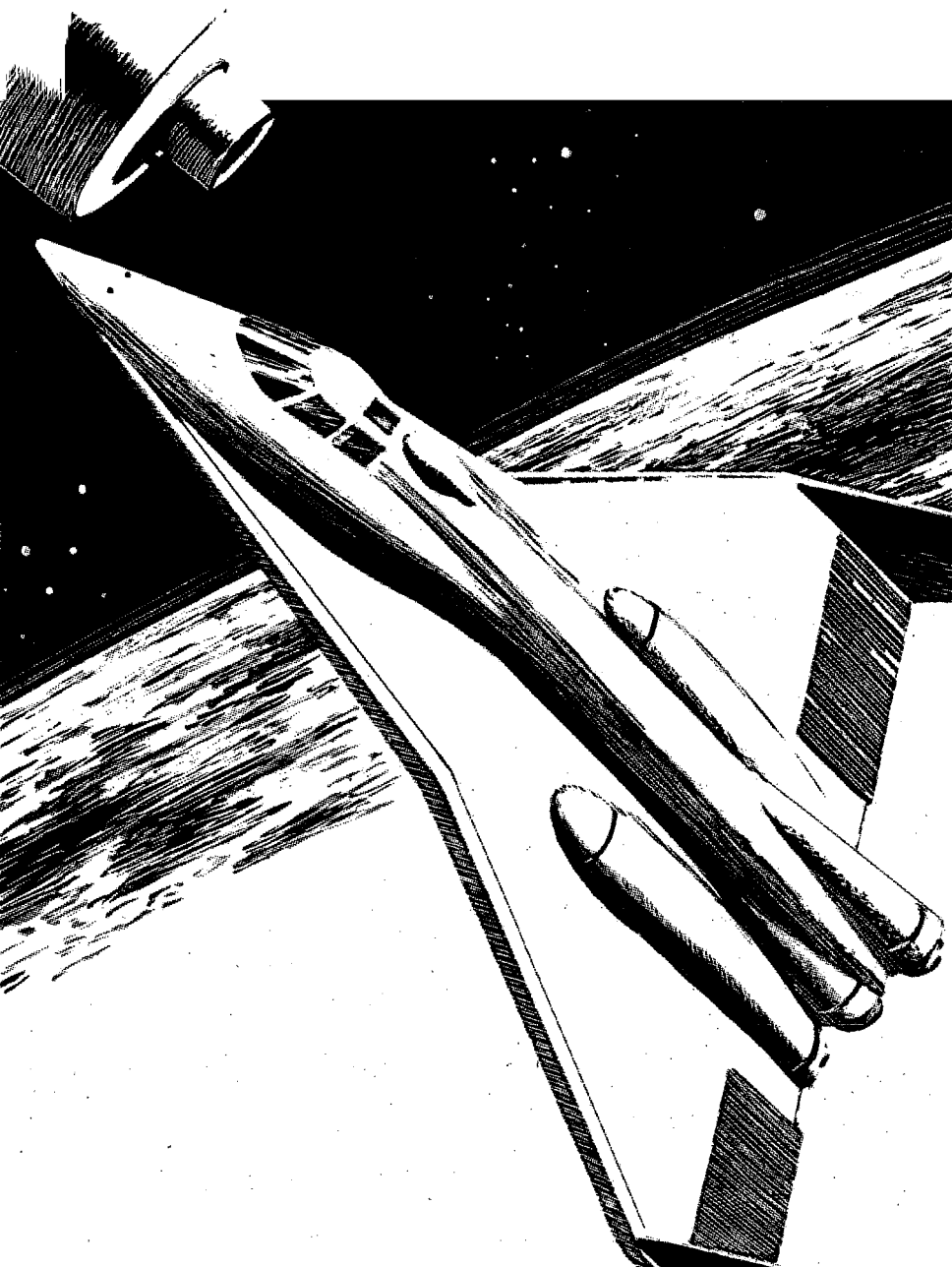

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Very old and
very new ideas can come together
in unexpected ways. . . .

BOUNDARY CONDITION

Wil McCarthy
Illustration by Vincent DiFate

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We saw in the vale below us a whirlwind beginning in the road, and shewing itself by the dust it raised. Riding close by its side, I tried to break this whirlwind by striking my whip frequently through it, but without any effect. The circular motion was amazingly rapid. I accompanied it about three quarters of a mile, till some limbs of dead trees, flying about and falling near me, made me more apprehensive of danger; and then I stopped, looking at the top of it as it went on, which was visible for a very great height above the trees.

—Benjamin Franklin, 1755: "To Peter Collins"

0.
Space, Near Future

Death comes upon us in surprising ways. If it didn't, we'd arrange to be somewhere else, right? And in the wake of death we find an obsession with time. When did this happen? When did it start? How long have *I* got left? But whose time should answer these questions? Whose calendar and clock?

On a space station in low-Earth orbit, there are no easy answers. The Sun comes out every 90 minutes and stays for 47 before sinking back behind the limb of the blue-green planet below, and the station passes through 25 different time zones along the way. For sanity's sake, Russian stations set their clocks to Moscow's "Charlie" time, three hours fast of Greenwich, England. The Chinese are synched to Jiuquan's "Foxtrot" zone, and the handful of truly international stations are on Universal or "Zulu" or Greenwich Mean Time. London, in other words.

Where death comes upon Americans in space the situation is more complex. If you work for NASA, you log absolute time in two zones at once: Zulu and Romeo, which might stand either for Cocoa Beach where the rockets actually launch, or possibly Washington, D.C. where the checks are written. It hardly matters, because the routing of voice and telecom through Building 30 at Johnson Space Center makes these outposts a mobile extension of Houston, Texas.

The Air Force stations, on the other hand, like to keep it simple. It's Zulu time and metric units, never mind where you came from or where you think you're headed. And for some reason, the two fledgling space hotels—little more than boxcar-sized inflatable hot dogs—follow the military paradigm.

On the *other* other hand, should you be lucky enough to work for the National Weather Service—a.k.a. "Not Wet, Sir" if you like them or "Nitwit Circus" if you don't—you live on Sierra time. That's Omaha, Nebraska, son, and don't you forget it. The spaceplanes take off and land on the runways at Eppley Field, and the tracking network is headquartered just seventeen kilometers south at Offutt Air Force Base. Even the checks are written locally; between its subscription-only news network and its weather control services, its multimedia archives and its growing tourism business, NWS is officially self-sustaining, and may soon be handing a surplus back to Uncle Sam.

In olden times it was glamorous hereabouts to be an aviator, or to work for the railroads, or even (strange to imagine it!) to be a humble letter carrier for the Pony Express. For now it's the men and women of the Weather Service—most especially the Stormbreakers—to whom these envies accrue. Thousands of hopefuls move here every year with the dream of signing up, though fewer than twenty are accepted.

So, never mind that in low-earth orbit the Sun rises and sets 16 times a day; on an NWS station your morning is the Nebraska Cornhuskers' morning, and your evening occurs as the Sun slips down behind the lone tower called "Prick of the Prairie" and settles into an ocean of Tango-zone corn and buckwheat.

Wave to Headquarters as you soar high

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above; the city is instantly recognizable even from orbit. Surrounded by that grassy ocean, Omaha's southwestern edge has, in recent years, finally blurred into the outer fringes of Lincoln. Its eastern frontier encompasses the city of Council Bluffs, Iowa. But sail a little farther and you're in the open sea, where the cornstalks outnumber the human beings twenty million to one. Where the nearest civilization is 225 kilometers away, and it's only Des Moines. So if the Gate to God isn't exactly the most cosmopolitan city in the world, you should understand in all fairness that it doesn't need to be.

Oh-MA-ha, the locals call it, when they're in a mood to chuckle. The Big Island.

It was with great secrecy—disguised as dull routine—that a particular spaceplane lifted off from this site, this place in the middle of no place, and lit an Orbital Insertion Motor that flung it hard toward an NWS station speeding 500 kilometers overhead.

"Relief vehicle away," said a bored-sounding flight controller. "Tell Dewey Park their replacements are *en route*." It was a half-truth at best, but a half-lie at worst. The National Weather Service is nothing if not pragmatic.

But this young man was in on more secrets than his managers supposed, and while he spoke there was a dead body cooling under his desk—the first of many who would lose their lives in the coming spasm of transformation and realignment. The why of this is difficult to explain even now, though the where and when and how are little in doubt. But in some sense the motive for murder—even mass murder—is always the same: to control the future by removing people from it.

1.
Shuttlerise

Catskin. Iceland Spar, medium. Hand and Bladder Glass. Magdeburg Hemispheres. Lodestone. Tantalus Cup.

—"Apparatus and Material for Experiments in Physics", *CRC Handbook of Chemistry and Physics*, Cleveland, Ohio, 1913.

"Onigiri," said Tomohiro Sato, holding up one of the sticky rice balls he and Chip had been whipping up in the galley these past few weeks. They were the size of small peaches, and with a bit of salty fish paste in the center, they were *good*. They also held together in zero-g, making them the only decent way to eat rice up here without a godawful mess.

"Rice ball," answered Jiminy Gomez, wondering what the zinger was this time. Tomo—a famous weatherman in his own country—was here on Dewey Park Station to learn the delicate art of the Free Will Index forecast, and he seemed determined to teach something of comparable value in return: the art of the bilingual pun.

"Nigiri means 'squeeze,'" Tomo explained, as they drifted through the gray-white pressurized tunnel connecting the trailing sensor arm to the station core. "With your hand, right? To form the rice into a ball." His accent wasn't perfect, but it was good; only the pacing really betrayed him.

"Okay, so what's the 'O'?"

Tomo waved the question away. "Unimportant. Means 'elegant.' You stick that on a lot of words. Shiri means 'ass,' right? 'Oshiri' means derriere. Much nicer."

With that, Tomo tossed the rice ball to Jiminy, who'd had six long months in zero-g and caught it easily. He eyed it *un*easily, though. Where was the gag?

"You like?" said Tomo. "Go ahead, eat it. Exercise your free will."

Hmm. Jiminy could feel the ghost of a punchline out there somewhere, but he didn't have enough information yet. He was going to get zinged. Again.

"Please tell me this has nothing to do with your ass."

Tomo laughed. "Not this time. But you

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eat that thing, it means you owe me a debt. The word for that is *giri*, and if you take that off you're left with *oni*, which means 'goblin.' *Oni giri*, the debt owed to a goblin."

Jiminy made sure Tomo could see him rolling his eyes. "They call you the Weather Wit? Really?"

"Ah," said Tomo, waving that away, too. "You spoiled my rhythm. You know how you say 'Jim knows a little Japanese?' *Jim wa nihongo hanashimasu.*"

As Tomo said this, he turned in mid-air and touched his finger to Jiminy's nose at the word "knows," and again at 'hana,' which was the Japanese word for nose. A double-entendre? A triple? A bilingual triple entendre?

"Hmm," he said, thinking that one over. Clever was not quite the same thing as funny.

They passed through the final hatchway—about as wide as a standard doorway back home—and into the station core. It wasn't much; just a bus-sized fiberglass habitat module—the Hab—serviced by a spiderweb of rollout carbon trusses and inflatable Kevlar tube tents. Dewey Park covered as much footprint as an aircraft carrier, but inside it had the volume of a midsize submarine, and only weighed as much as a Lear Jet.

If the two NASA stations were Cadillacs—classy, rugged, and safe as houses—then the three NWS ones were more along the lines of an Indian Tata. That is to say: flimsy, maintenance-hungry, and cheaper than their own weight in gasoline. If Jim really wanted to, he could puncture the Hab wall with a ballpoint pen. But hey, that was life in the Service. With a big job and a small budget, they simply couldn't afford to be too cautious.

"You want to hear an actual joke?" he asked Tomo. "I'll tell you a joke. You know the Pope?"

"Personally? Okay, okay, yes, I know who he is. You just got a new one, right?"

"The Catholics got him, yeah. Not me personally. Anyway, he was just crowned: Dave the First, the American pope. And he's supposed to go to New York City to catch a plane to Rome, so they pack him in this bulletproof Popemobile, and he's surrounded by bodyguards. One of them's driving, two are in the back seat, one's on the roof. . . . And it suddenly dawns on old Dave that these guys will be on him like glue for the rest of his life. Never a moment alone.

"Buuut . . . just as quickly he realizes he's the boss here. These guards have to do what he says. So he says to the one who's driving, he says, 'Slide over. I'm taking the wheel.' And what can the guy do? He slides over, and Pope Dave starts driving."

"Uh-huh," said Tomohiro, crossing his arms like this was already the worst joke he'd ever heard. He was slowly tilting, too, which in zero gravity was a subtle way of dissing someone. If you were interested, you didn't drift; you kept yourself aligned with the person you were listening to.

But Jim pressed on. "So anyway, it's not built like a normal car, and he's not used to the controls. He's wandering in and out of his lane, can't hold a constant speed. Pretty soon the cops pull him over, so he rolls down the window like a good citizen and hands over his driver's license. And the one cop says to the other cop, 'Holy shit, we've got to let this guy go. He's *really* important.'"

"'What makes you say that?' says the other cop. He's not looking, right? He's filling out paperwork. And the first cop turns to him and says, 'I don't know who he is, but he's got Pope Dave for a fucking chauffeur!'"

Tomo processed that for a few seconds, then spent another few trying not to laugh. But it *was* a good joke, and it broke out a decent chuckle.

"See?" said Jiminy. "*That's* a joke. Now if you'll excuse me, I've got to find my headset in time for dock ops."

"Oh. You should hurry," Tomo said. "We don't really have that long."

Jim slid open the fanfold of his cabin,

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which was about the size of three coffins stacked vertically. (How much space did one person really need? Especially in microgravity?) He drifted to the back and commenced rummaging, finally locating his headset in the webbing of his top desk drawer. Safety and command protocols aside, he didn't normally wear the thing indoors. It chafed and squeezed, and after enough hours it would turn his whole ear red. This one was dead, of course—he was always forgetting to turn it off—so he swapped in the battery waiting fresh on the charger, then slid the whole thing down over his head and right ear, carefully adjusting the microphone to the proper angle and distance from his mouth. The headsets had literally come from Radio Shack, and were *damned* flaky about things like that.

Finally he switched it on, and was greeted by the chatter of Bob Cass and Lisa Goho in the control cupola at the "top" of the Hab, i.e., the part facing away from Earth. Opposite the docking module, so they could guide the shuttle in with minimal risk of being personally crushed by it. Bob was the station commander, Lisa was the X.O., and both of them were pilots. Indeed, they would be flying that same shuttle back to Earth tomorrow afternoon.

"Aaah, closing rate 3.6 meters per second," Lisa informed the channel flatly. "Recommend another deceleration toot."

"Aaah, roger that," said an unfamiliar voice—the shuttle's own current pilot. "Be advised, we are still lining up the final approach. Expect a burn in approximately fifteen seconds."

It went on like that for some time. The "Aaah" was to trigger the mics in voice-activated mode. Without it they would step on the first second or two of actual speech, with sometimes-calamitous results. It was an old and effective method for talking hands-free on a half-duplex channel, but it did pretty much make them sound like retards. "Better radios" were always high on the NWS Astronautics wish list, but you know, good radios were *way* more expensive than the ones that could just barely get the job done. The astronauts had offered many times to buy the radios themselves, out of pocket, but that was seen as a bad PR move. "Next year," the brass kept promising. They couldn't turn a profit, after all, by spending money on frills.

Robert and Lisa had CNN running up there in the cupola as well. This struck Jim as both disrespectful and a wee bit dangerous, but then again he himself had never been more than an air tanker copilot. NWS space pilots were all former Stormbreakers, almost impossible to fluster or distract. They'd spent long hours of their lives in thunderheads and hurricane eyewalls, dropping surfactant or sealing oils, shutting down the weather's engines of rage. Space station duty was positively dull by comparison.

So in the background Jim could hear that the President was in Louisiana, where the Chinese Premier was speaking out not only against biodiesel (which in his opinion was full of turkey prions and therefore more deadly than nuclear waste), but also against prayer and meditation, which "rob us of the very freedom of our souls." Uh-huh.

"You guys had better get down there," advised Chip, the Station Engineer, from the galley niche where he was assigned this shift. He was glumly washing the dishes one-by-one, in a plastic bag filled with soapy water. Everyone knew it was a duty he hated. But he was also wearing a headset, and apparently keeping closer track of the dock ops than Jiminy himself. "You've got, like, two minutes. If you're lucky."

"Shall we?" Tomo asked, gesturing at the deck hatch located directly beneath the sealed control blister. Their own mics were in push-to-talk mode, so they couldn't step on the channel by mistake.

"Yeah," Jiminy agreed, swiveling head-down so he could grasp the hatch's locking ring. Balletic movements like that were second nature to him by now, but

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the thrill had long worn off. Being a spaceman was fun, and the bleeding edge of a new science was always a good place to park yourself. Just about everything he did up here was a major contribution in one way or another—he was one of the world's first quantum weathermen; his place in history was assured. Nevertheless, he was ready to be *home*, to eat cheeseburgers and smell fresh-cut grass again, and he had a hard time believing his escape was really imminent. Surely *something* would screw it up. But just as surely that something would not be Jim Gomez himself, so he grabbed the ring, planted his toes under a pair of holding rungs, and twisted the latch open.

Tomo then helped him raise it without banging it—there were no cushioning pneumatics here—and then slipped into the docking module feet-first, like a cold-weather diver going down through a hole in the ice. Jim followed behind, headfirst but with his feet curled up against him. He pulled the hatch down after him and sealed it, while half-audibly in his headset, CNN boasted of "Yet another upset for Green Bay!" and then cut to a laxative commercial.

It was gray-white in here. The docking adapter was mostly thin plastic, which was *frightfully* reassuring given the larger-than-normal spaceplane barreling toward it at what looked like higher-than-normal velocity.

"Holy crap!" Jim said, putting his face up against one of the portholes. "What the hell is that thing?"

"It's the 210," Tomo answered, with his own nose pressed up against the other porthole below Jim's. "Fresh off a line at General Spaceplane."

"Really? Already? I thought the first one wasn't due until next year."

"Might be the prototype. Look, the thing has been modified. Cargo bay looks bulging, and those aren't the stock bay doors. They look like blowaways. And what is that *thing* behind the docking collar? Is that a reentry vehicle? Some kind of escape pod?"

For a weatherman, Tomohiro Sato knew an awful lot about spaceplanes. It was why the Japanese government had sent him here, Jim supposed, and why the NWS had accepted him.

"Is he coming in a little hot?"

Tomo shook his head. "I don't think so. It just looks fast because the shape is more . . . well, I don't think so."

Jim watched the nose thrusters firing little puffs of white steam, like the pipes of an old calliope. The oversized craft slowed, and slowed some more.

Jim's headphones said, "Commander Cass here, to all Dewey Park personnel. I am suddenly informed that this is not a standard relief mission. We've got some sort of VIP in there. You've all got active clearances, right? Because as of this moment, everything that happens until that shuttle leaves is classified Confidential under diplomatic seal."

There was a clank, as the shuttle's docking ring made contact with the larger adjustable ring on the station's dock module. Tomo kicked on the electromagnets, and Jiminy immediately started cranking the physical clamps shut, so an errant puff from the shuttle's attitude motors couldn't pry the two vehicles apart at some not-so-funny angle. Within moments, the seal was airtight and very strong; the ship and the station were one.

"Docking clamps at full compression," he said, slapping the push-to-talk on his belt.

"Aaah, roger that," Bob Cass replied. "Please equalize pressure and stand by while the hatches open."

The "please" wasn't so much a courtesy as an NWS radio convention, indicating that what followed was an order rather than a recommendation or an info request.

"Roger that," Tomo replied, twisting the valves open partway. Once he was satisfied they weren't sucking vacuum, he opened them fully. They hissed for a moment and then fell silent.

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Jiminy could see Tomo itching to open the hatch as well. Properly speaking, it was the station crew's job to open this side, and the shuttle crew's job to open the other. Tomo was just as impatient as Jim to get back to Earth, a process that obviously could not begin without an open hatch. But in NWS jargon, "please stand by" was roughly equivalent to "sit down and shut up," and left no room for personal initiative.

Below, there were squeaking and banging sounds, as of locking wheels being rotated and doors being opened. But whoever was down there, they were taking their own sweet time about it.

"VIPs," Jim snorted. "The last one we got here was *you*."

"I was a VIP?" said Tomo, sounding surprised. "It's funny, the service hasn't been that good. I mean, who do I have to sleep on to get a beer around here?"

"Sleep *with*," Jim corrected helpfully; he also considered himself Tomo's Gutter English tutor. "We've been over this. And you really should work the phrase 'the living fuck' into it somewhere."

Jim was hanging upside down when he said this, and as luck would have it the hatch chose that precise moment to swing open, with a person's head prairie-dogging up right behind it, so that the word "fuck" was breathed directly into the face of Dewey Park's mystery visitor. And this turned out to be a *really* bad way to start off the morning, because the face belonged to none other than His Holiness, Pope Dave the First.

"Bless you!" the pontiff returned brightly, as if excusing a sneeze.

2.
Divine Wind

Only in recent years have aerologists given much attention to the slow-moving currents of the lower strata of the atmosphere. In what way can this best be done?

—*Popular Science Monthly*, July 1915

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There was some initial shock while the Pope and his attendants filed up into the station one by one. This mission had been planned in such secrecy that even Robert—the station commander!—didn't know, and didn't believe it when told. Heck, at first he didn't even believe it when the Pope and his attendants floated up out of the docking module right in front of him. Truthfully, it *was* hard to recognize Pope Dave at first glance; Tomohiro hadn't, and neither had Chip. After all, "His Holiness" was wearing a perfectly ordinary NWS flight suit, albeit with the pressure helmet detached, and he was also surprisingly short, which was something you didn't get from seeing him on TV. In gravity, the top of his head would come no higher than Jim's nose, and Jim was barely five foot ten! Pope Dave's only concessions to his station were a heavy gold ring of some kind, and a flat white cap, like a Jewish yarmulke, bobby-pinned to the crown of his head. And those could mean anything, really.

But the face was familiar, in the way that famous faces always are, like an old teacher from your past, or some friend you haven't talked to in a while. It was the attendants who really cinched it, though; in jet-black coveralls with some yellow-white European flag on the breast, with feathered caps and wraparound sunglasses flickering with numbers and text and diagrams, they looked like some weird, twenty-first-century version of the jacks in a deck of playing cards. At the sight of them, Jim had flashed on a title: Swiss Guard. That was about the extent of his knowledge of Vatican culture, but he was sure he'd seen these guys on TV or something.

Any lingering doubts were demolished when Barney Hopper, the Pilot Commander of the shuttle and, up till now, a stranger to Jim, came up through the airlock and made the formal introduction: "His Holiness Pope Dave, Bishop of Rome and, uh, Sovereign of the Vatican City . . . I forgot a bit there, didn't I?"

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"No matter."

The station crew stammered out a number of fragmentary questions, which the Pope answered with smiles and a disarmingly deep sort of patience. Yes, he really was who they thought he was. Yes, he'd had a pleasant flight, not nearly as rough or as crushing as he'd expected. Yes, the weightlessness agreed with him just fine. He'd done two days' training on the NWS Vomit Comet before coming up here, flying up and down and up and down again in zero-g parabolic arcs, and no, thank you, he didn't need a motion sickness patch. He then turned to the guards and said something in German, and they replied tersely in Italian, or perhaps Latin, shaking their heads. No, they didn't need medication either.

The Swiss Guard had that same unflappable look you saw with Secret Service agents left out in the sun, or in veteran cops surveying a nasty crime scene. They were uncomfortable, yeah, but so what? The job came first. Except for occasional reaching to the cabinets and Hab wall for stability, they managed to stand more or less at attention, and to look cool doing it. Which was no mean trick in zero-g! By contrast, the Pope himself did seem a bit puffy and dazed.

He also radiated an infectious sense of peace, though, which Jim distrusted immediately. Religious people often carried themselves this way; with the calm of absolute certainty. Jim, for his own self, had never felt that certain about anything, including death, taxes, and the falling of a second shoe after the first one had dropped.

"Listen," he said diplomatically, "I don't mean to be rude, but Chip here needs to get down in that shuttle and find the card pullers you guys were supposed to bring up. You did, right? And since we're coming up on North America again for the start of our daily readings, I've got to cycle the sensor arrays and strap in."

"The life of a weathercock, eh?" said the Pope with mild amusement. Was that a dirty joke?

"The Earth keeps turning," Jim agreed guardedly. "The weather never stops."

"Very true. I have to say, young man, I'm honored to live in such privileged times, and to meet such pioneers as yourself. This is *God's* weather you're talking about—a frontier for scientists and theologians alike."

Jim shrugged. "It's always been there, sir. And if I'm going to measure it on schedule, I'd best step lively. Will you excuse me?"

To which the Pope just smiled again, placing two fingers on Jim's arm. "Actually, your readings are exactly what I'm here to observe. You're Jiminy Gomez?"

"Saint Jim," said Lorraine Kennet, hovering in the airlock hatchway. "God's own private secretary these past six months. How you doing, bud?"

Now that struck Jim as very rude, for two reasons. First because he didn't believe in God, or that kind of God anyway, and second because the Pope obviously did. Shooting a glare at Kennet he said, "I've asked you not to call me that. I'm a meteorologist."

"No one has suggested otherwise," the Pope assured him. "And I shouldn't allow my presence to interfere with your important schedule. But I'd like very much to accompany you and watch the process. I have a thousand questions already!"

"Sure," Jim said slowly, because what else was he going to say? The guy was a VIP; if Jim didn't show him around voluntarily, he'd do it under orders.

At this point, the commander piped in with a, "Take Saint Lorraine with you, too."

Lorraine Kennet was Jim's replacement for the upcoming six-month rotation. She'd be taking over tomorrow, just as soon as Jim stepped aboard that shuttle. And she was bloody welcome to it.

Twenty minutes later Jim was strapped into the telemetry chair at the station's geometric center, and Saint Lor-

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raine was lowering a colander-shaped cap down over his head, like they used for executions in the electric chair. This one wasn't a simple metal electrode, though, but an array of two-inch wafers called "gallium arsenide quantum wells," which helped focus the weird subatomic energies storming around here at any given time. There were decoherence sensors all up and down the long arms of Dewey Park Station, but by far the most sensitive detector was Jiminy Gomez himself, whose brain fell far outside the normal human range for quantum decoherence events. That Jim had an above-average IQ was beside the point; there was a lot more going on inside his brain than mere cognition, and in the relative silence of low Earth orbit, these events could be measured very clearly and accurately.

"Ready?" asked Kennet with a look of concern, for she knew better than anyone how disorienting this business could be. She'd only ever done it Earthside, though, and she was wise to observe the process once or twice before assuming full responsibility for it. It wasn't worse up here, but it was . . . different.

"Ready," Jim told her, at which point she went ahead and threw the switch. Coils hummed to life around Jim's head, and the base field settled in with a taste like bitter metal in his mouth, and with a vague buzzing sensation the flight surgeons had never adequately explained. The field was D.C., not A.C., and should not "buzz" unless it was interacting with Jim's neurons in some kind of unknown way. He didn't much like that idea, but the weather, as they say, never sleeps. Anyway, between the flight pay, hazard pay, and travel compensation, and the fact that his wife was planning to leave him—or he had already left her if you wanted to get technical about it—Jim considered it an acceptable risk.

"You're like a damn Christmas tree," Kennet observed as the monitor screens began to flesh out an image of his brain, rendered in twinkling points of starlight. This, at least, didn't feel like anything at all. Jim's brain had been decohering all his life, and on the occasions when the events were suppressed by outside forces—by "miracles" if you wanted to call them that—he didn't feel any different. But for whatever reason, he did sparkle brighter and brighter the higher he got from the Earth's surface. It was why he was up here, why all of them were.

"This is free will?" the Pope wanted to know. There was a gleam in his eye—of interest? Of holy terror? "These are small miracles, the thoughts of Jiminy Gomez overpowering the laws of physics?"

"Nothing overpowers the laws of physics," Jim told him firmly but wearily, because he'd answered this question way too many times in the past few years. "These are 'decoherence events,' and they're a natural process, albeit one we don't fully understand. On a much smaller scale, the same thing happens in a quantum computer."

But that wasn't exactly true, and the Pope seemed to know it.

"Listen," Kennet said, "Your, uh, Your Holiness . . ."

"Please, just call me Dave. David Wayne Stassi. I'm a person, like you."

And that was a bit *too* true, because it was widely rumored that Dave, like Jim and Kennet and a few hundred others worldwide, was a saint. That is, he had a really unusually high DQ, or decoherence quotient. In fact, his was supposedly one of the highest ever recorded.

"I thought you were supposed to change your name," said Kennet. "When you were crowned, I mean. Or mitered, or whatever it is they do."

Pope Dave just shrugged at that. "Knowing I was a reformer, even a radical, the Cardinals elected me anyway. I wasn't the first to refuse the Papal Oath—otherwise known, I kid you not, as the Oath Against Modernism—but there haven't been many of us. And that name thing just stuck in my craw. Why change? Why reinvent myself to fit this

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role? It was the first of many traditions overturned."

A strong statement, considering Pope Dave had been in office for just under six months. He'd mentioned he was fifty-four, but he didn't look that old; his hair was still black, fading gracefully to silver at the sides. And he'd done that puppet show thing on PBS, and he'd written one or two New York Times bestsellers about psychology or something. The proceeds had no doubt gone to worthy causes, but still he seemed an odd choice to be the Pope.

As if sensing Jim's thoughts, Dave shrugged again and said, modestly, "The Cardinals claim they were divinely inspired. Or if you prefer, they saw me as a man in step with the changing times, and followed their gut. Better the upheaval you know than the upheaval you can only guess at, eh? Or maybe they panicked. I'm not sure *I* would have picked me if the choice had been mine to make, but you know, sometimes the shock of novelty brings us closer to the truth."

"So now you're infallible?" Kennet asked, again rudely. She was one of those people who were determined to behave exactly the same toward all people in all situations. You simply couldn't impress her with titles or credentials, or money or charm or wit: On the other hand, she was just as difficult to offend.

"Ah," said Dave, clasping his hands briefly in a gesture of humility. "You know, there's a lot of disagreement on that point. It's a touchy subject. Some would say that if I screw up, it'll prove I was never the legitimate Pope to begin with. Others would say the *office* is infallible; according to Paul's testimony, Jesus granted him the right to speak for heaven, and to bind it to his word. But even taking that at face value, I'm not Paul. The very concept of Papal infallibility is a modern invention, dating to Pius the Ninth in the late eighteen hundreds. In my opinion, Miss Kennet, the best I can do is pray for guidance and apply my own judgment. I would not expect that combination to be right all the time."

Kennet seemed ready to work another jab in, for fun or curiosity, just to see what might happen. She was a real social scientist, that one. But fortunately the stats were coming in on Jim's decoherence events, and suddenly the anomaly warning was flashing and chiming. Jim looked over the monitors and said, mainly for Kennet's benefit, "Bing, bing. I read negative slope, negative concavity. There's a major boundary condition trying to impose itself here. Type alpha, magnitude 4 or 5, extraterrestrial origin and centroid. Do you concur?"

"Um, yeah. I'd call it around 4.7."

Although it wasn't evident from the picture of Jim's brain, there was a kind of stuttering going on at the quantum level, as external forces tried to suck all the Heisenberg uncertainty out of this volume of space. If not for the human brains here trying to do the same thing on a microscopic level, the decoherence hypercone or "deek" would have succeeded already. In a deek, particles could move or change energy without seeming to. Events could be influenced; outcomes could change. "Miracles," some people called them.

Finally it found its opening: a moment in time when there were no interfering flashes inside Jim's head—or Kennet's, or Dave's, or anyone else's on the station. The results were brief, and like anything involving the word "quantum", they could be interpreted a variety of ways, and visualized only by analogy and metaphor.

Jim liked to picture a major deek as a swarm of hungry bubbles, growing from pinpoints and rapidly expanding to the size of buses, or even whole space stations, before popping and vanishing and being replaced with new bubbles. "Decoherence" was the collapse of quantum uncertainty, and "hypercone" was the shape these events sketched out in four dimensions. "Hungry" was Jim's own term, because what the bubbles wanted

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was *space*—great volumes of it to expand unimpeded. But no two deeks could overlap, so the presence of a human mind, fizzing with its own little microevents, broke the symmetry and prevented large hypercones from forming. In layman's terms, human thoughts were "stepping on the channel."

The result—the analogy, the metaphor—was a cluster of bubbles clinging to the space around Dewey Park Station, waiting for their moment to pounce. And when the moment came, the bus-sized deeks vanished and were replaced by something much larger. Now it was Jim's own activity that was suppressed; the scanner showed a blank where his brain should be. He was still breathing, still thinking and feeling, still going about his business. He could speak or dance or whatever, and as far as his senses were concerned, nothing had changed at all. Was he really on autopilot? Soulless, a meat machine? The channel was being stepped on by something much larger than himself; according to the instruments, his free will was gone.

The event trying to happen here was somewhere between ten and 100 kilometers across—or sixty-three by Lorraine's estimate—and since Dewey Park Station was hurtling above the Earth at seven kilometers per second, they passed through it in just a few seconds and were out in clear space again, where he was once more the captain of his soul. But then, on the heels of it, came another, slightly smaller deek.

"What miracle is this?" the Pope wanted to know. His eyes were wide, hungry, amazed. "What's changing? Something big is happening here!"

"Not really," Jim told him. "We get these little blips all the time. It's just weather."

A type of weather undreamed of even five years ago. The weather of the soul, some called it. Manna from heaven, the miracle rain. A symphony of quantum decoherence on a cosmic scale, sweeping through the solar system and battering into the Earth like a kind of wind. And if "free will" could be said to exist on the quantum level—if human thoughts could guide and tweak the subatomic processes that gave rise to them—then these storms were of great consequence indeed, for they quieted the brain's "little miracles." They had other effects as well, which a worldwide scramble had so far done little to decode.

"Get the Stormbreakers up there," the President had famously remarked. "If this 'quantum wind' affects our security I want to see it coming." And here they were.

"Overall," Jim said, now to the Pope, "the trend is down, which is what we'd expect for this time of week."

"Ah. Right, yes. It peaks on Sunday." His eyes had taken back that knowing gleam. Was certainty the enemy of wonder?

Again, Jim felt a flutter of annoyance. "It peaks when it peaks, sir. In the U.S. and Western Europe, it often happens on Sunday, yes. But that's already Monday in Australia. It can happen on Saturday, too, or Friday, or sometimes even Thursday night. I wouldn't read too much into it."

"No," the Pope mused, with a little smile. Sure, because any data Jim gave him would simply confirm his own models of how the universe should work. Anything truly anomalous would be rejected, right? Critical thought was a skill anyone could learn but few people really wanted to. Like knitting. Arguing the point would be sort of interesting—trying to convert the Pope himself!—but with little hope of success and a great probability of pissing off his superiors, Jim opted to ignore it and press on instead with his work.

Which was uneventful, as it turned out. They made it through the rest of the orbit with only three more major deeks, making this a quiet day indeed. Throwing off his buckles and lifting out of the chair, Jim moved to the instrument console and messed with the laptop-style touchpad there, switching between a couple of different window views on the

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monitor. First derivative, second derivative, absolute magnitudes and station ground track . . . Looking these over, Jim thought for only about fifteen seconds before rendering up his forecast. "Projected Free Will Index of 9.2. Call Earth and let them know it's going to be an interesting Saturday night."

"You called it a boundary condition," the Pope said. "Not a miracle."

"Uh, well," Jim answered, reaching up to scratch his face and trying hard not to grimace. "It's not a value judgment on my part. I mean, a boundary condition is any point in time or space where certain variables are nailed down. When you start up your car in the morning, its speed is zero. When you park it at the end of the day, it's zero again. In between it might vary quite a bit, but those two zeroes are your boundary conditions. The system is fixed at those points."

They were in the wardroom, the lounge and dining and recreation area of the main Hab, where Jim had gone to recuperate after his ninety minutes of data taking. He wasn't exhausted or anything—the job wasn't *that* hard—but he did need to clear his head and drink a sippy mug of coffee. Pope Dave had followed along behind him, far more dignified than a puppy but no less eager.

"I don't understand," he said. "The words make sense, but I'm afraid I don't know how to apply them."

You could never be truly alone on a station this small, but Kennet was still back in the weather lab, checking out the equipment she'd be using for the next six months, while Chip was off fixing the backup file server and Tomohiro was in his cabin writing an email or something. Robert and Lisa had work to do up on the bridge, and one of the Swiss Guard was up there with them, either watching for danger, watching *them*, or monitoring communications or something. The new shuttle crew was down in their vehicle, powering down flight systems and putting the thing in docking mode, so it could draw from the station's solar arrays rather than its own limited fuel cells. Jim knew from experience that the flight crew had gear to stow, personal effects to unpack, checklists to run through with ground control, and all sorts of other little tasks. They were handing the shuttle off to Robert and Lisa in the morning, but they themselves would be here on station for the next six months.

For the moment, the only person here was the other Swiss Guard, and he was hovering discreetly in the distance, managing somehow to look alert and take in everything without ever really turning toward His Holiness or Jiminy Gomez, or seeming to eavesdrop. So Jim and the Pope were *kind of* alone. Which was a strange experience, definitely.

"Here," Jim said, "I'll show you."

This particular issue had come up so many times that he'd finally written a Java applet to explain it, and posted the thing on his web page. And finding a computer here on Dewey Park station was never a problem. The walls were practically made of computers, so Jim moved to the nearest one and opened up his web page, noting the very slight delay that came from bouncing his request off a communications satellite and down to Earth, and from the return signal following the same path on the way back up. Still, it was only a few seconds before the desired window appeared on his screen, with the heading JIM'S TINYVERSE at the top. And indeed, this Java universe was very small and wonderfully simple: just 10 little dots bouncing around in a black square box. Bouncing off the walls, and each other, in perfectly elastic collisions with no inertia or rotation or other messy physics.

"Can you see this?" he asked the Pope.

"I'm not blind," Dave answered agreeably.

"All right, well, for this run the balls started out in a random pattern. But I can impose any pattern I want, any combina-

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tion of initial positions and velocities. I can make them start in a particular shape, like a square or circle. Any shape you want."

Amusedly: "How about a cross?"

"Um, sure, I can do a cross." Jim used the touchpad to freeze the simulation and drag the dots around. "Just to illustrate my point, I'm going to use random velocities. But the same rules apply whether we do that or not. Anyway, here's your cross. When I restart the simulation, the balls will all fly apart. See? Now, you . . . are you watching them? They're going to . . . They're going to bounce around forever, until the end of time. At this point, I don't have any further control over the system. It's running on autopilot, but that cross shape we had at the beginning—that's a boundary condition. We forced that on the system. It's not a variable; we constrained it to behave that way."

"All right. That's a clear enough concept."

"Thing is," Jim said, "we don't have to impose that condition at the beginning, or in that exact spot. We can move it to a different point on the screen, and in exactly the same way we can move it to a different point in time."

He froze the simulation again, slid the keyboard out on its track and began rattling off keystrokes.

"I understand what you mean," the Pope said. What he seemed to imply by that was, You don't have to do this work just to show me. I can probably figure it out from here.

But it was familiar work, not at all difficult, and in half a minute Jim was done anyway. With a theatrical flourish, he restarted the program. "Now watch this clock over here, because in thirty seconds something interesting is going to happen. The balls are still bouncing, right? But I didn't pick their initial positions or speeds this time. Instead, I *calculated* those values to get a particular effect. Are you watching the clock?"

"I am."

The time ticked over: 20 seconds, 25, and then suddenly the apparent disorder on the screen began to vanish, as the dots momentarily came together to form the shape of a cross. And then flew apart again.

The Pope began to laugh. "It's a miracle!"

"It looks like one, yeah," Jim agreed. "Order emerging from apparent randomness. But in fact, this entire universe was constructed to make that one event happen. And I'm a poor substitute for God, because I can only do it once."

The Pope frowned. "Okay, there you've lost me."

"The system is running on automatic," Jim explained, scratching his ear nervously. "If it produces any additional patterns, it'll be by coincidence. I could arrange for that cross to reappear on a periodic schedule, but that's not a miracle either. That's clockwork."

He typed in some more instructions, and soon the cross shape was coming together and flying apart, coming together and flying apart again in an endless cycle.

"If this universe of mine were more complex, if it were shaped differently or if there were nonlinear effects between the balls, then chaos theory would come into play. The motion would be much harder to predict. Also harder to control. I can impose a boundary condition on this pinhead universe with only a handful of calculations. To do it on the real universe, I'd need to know the position and velocity of every single molecule, with absolute precision. My computer would have to be perfect."

"You'd have to be God, in other words."

"If you like. But even then, I could only do it once. If I try to impose a second boundary condition . . ." Jim demonstrated this by grabbing the dots on the screen one by one, dragging them back into a cross shape and freezing them there. "I have to defy my own laws of physics. The second boundary condition

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gives me away. If you were an astronomer, I couldn't fool you for a second with this kind of thing. You'd know right away that the universe was being tampered with."

"And it isn't," the Pope said. "Not in that way."

It wasn't a question. Indeed, there was a certainty in the tone that prompted Jim to ask, "How much astronomy do you know?"

"I was brought up a Jesuit," the Pope said, as though that explained anything. In response to Jim's blank look he added, "Seekers of God through knowledge, and through the realities rather than the ideals of human behavior."

"Oh," said Jim. "Don't those guys run a bunch of universities or something?"

"Prominent ones, yes. The philosopher Tielhard de Chardin belonged to the order, as do many notable scientists today. They're well represented among my advisors. But that's a digression, which keeps you from answering the obvious question here."

Jim quirked an eyebrow. "Yeah? What question is that?"

"How does *God* do it?" The pontiff spread his hands, genuinely anxious to hear Jim's opinion. "Boundary conditions happen all the time. We encountered five of them just now in that weather room, and I saw thousands of little ones pop off between your ears. How do you explain that?"

Ah, the hard cold glare of religion, always searching for chinks in the armor of science, and for methods to exploit it. Still, Jim considered truth to be the stoutest weapon in his arsenal, and he'd never been shy about using it. "Yes, well. There's a whole new science emerging just for explaining that, uh, Dave. And since it's a *new* science, I can't just look up the answer in a textbook and tell it to you."

"But it has something to do with quantum mechanics?"

"Right. And now you know as much as I do."

A chuckle. "Oh, I doubt that very much."

Just then, Robert poked his head down from the cupola and said, "Sorry to interrupt, but Jim, I need you to step outside and retrieve the radiation dosimeters. Flight surgeon wants them for comparison purposes, to measure against our personal badges."

Jim glanced down at his own dosimeter badge: a sheet of laminated white plastic that turned imperceptibly more gray with each passing day, each solar flare and cosmic ray. He smiled grimly and thumped the wall, which flexed slightly like the hull of a fiberglass boat, or like a Kevlar tent wall stretched very tight. "On the theory that this dishrag of a station provides any shielding? That's a nice thought, but I kind of doubt it. Do you want me to go now?"

"Please. You can buddy up with Kennet; she needs the training anyway. With departure ops starting first thing in the morning, I don't think you'll get another chance." Then he turned to Pope Dave and said, "Your Holiness, if it's not too much trouble I'm hoping to speak with you in private at some point."

"Of course," Dave answered, like any man of the cloth. Always ready to give counsel, to hear a confession, to offer such blessings as he could. A doctor for the soul, sworn to help wherever possible. But then he said something that really did draw the attention of the Swiss Guard on the other side of the room. "I'd prefer to postpone it, though. Commander, is there any chance I can go outside with Jim?"

3.
The Stars Themselves

Do not assume more variables than necessary.

—*Summa Logices*,
William of Ockham, 1320

How do you say no to a request like that? How do you say yes? The Pope had

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none of the appropriate training, and on a NASA or Air Force station they wouldn't let him *touch* a space suit, much less wear one. But this was the National Weather Service, where safety didn't come first, and anyway Robert's mingled sense of responsibility and deference gave him a lot of leeway.

"Promise me you'll be careful," he'd said to Dave. And a few minutes later, to Jim, in the relative privacy of the command cupola: "If anything happens, Gomez, I'm not letting you back inside. I mean that. I'm Catholic myself."

And Jim could almost believe the threat, and it made him kind of resentful. Why him? Why was he suddenly the babysitter for untrained VIPs? Because the Pope asked for him, yes. Because he could be spared right now, and because he'd done it a dozen times before and knew the dangers well, whereas Kennet had never been in space at all until today. But it was a *huge* responsibility—he could cause a hundred different kinds of international incident—and Robert wasn't asking his opinion.

Dave himself had done so, much to his credit. "I won't force myself on you, son. It's entirely your choice."

Which was still no choice, because refusing would make Jim look nearly as bad as screwing the pooch out there.

"It's no trouble," he'd lied.

So here they were, Pope and Weatherman, side by side in the airlock while the pressure slowly bled down.

"Aaah, what do you do about the itching?" asked Pope Dave, reaching up with a stiff, gloved hand and clawing at his helmet visor in mock distress.

"Aaah, you live with it," Jim told him. Then, because that seemed a little brusque, "It's not so bad once you're outside. More than anything it's the sensory deprivation in here. You get bored, you start looking for things to feel and do and worry about."

"I can smell my breakfast. And my teeth need brushing; I smell that too. I feel like I've crawled inside my own mouth."

"Yup."

Thirty seconds later, "I want to thank you for this. It's a dream come true, albeit a sin I'll pay for eventually. If those cardinals hadn't lost their minds last spring, I'd be on the ground right now with a billion other tourists who can't afford a ticket. Frustrated astronaut that I am, I saw my chance, and I jumped."

"Try to slow your breathing down."

"Ah. Right. I'm a little nervous."

"That's normal."

Another pause.

"You don't like to talk in here, do you?"

"Well, it's a safety issue. Simplex channel, you know, only one person can speak at a time. Chatter could mask a distress call."

"I see."

"It's just a reflex; I don't mean to be rude. Habcom, this is EV1. Are you all right with a bit of chatter?"

Around a burst of static Lisa Goho's voice cut in, "Habcom here. You've briefed our guest on the hand signals, right?" Lisa was originally from England, and had a *gorgeous* radio voice that cut through any amount of static or distortion. Her vowels and consonants were crisp; she got the words out quickly, without seeming to rush.

"Aaah, that's affirmative," Jim answered, in his own run-together Nebraskan.

"Then go right ahead, EV1. It's just me and this guard fellow on the channel, and I've got tank heaters to check. If you like, you can erase the recordings when you get back. For privacy."

"Roger that. Won't be necessary, but thank you."

The other reason, of course, was that chatter was simply more difficult out here. You had to have your squelch and volume set just right, and you had to keep your voice down to avoid blowing out your buddy's eardrum. And you had to trigger the vox with that stupid "Aaah," and you couldn't breathe too

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hard because that would set the microphones off, too. On the other hand, spacewalking with the Pope was something he could tell his grandkids about, and maybe that was worth a bit of effort.

"You track Satan as well as God, I hear," the Pope said, floating the words out like a straw archery target. "Two kinds of miracles, working at cross-purposes."

Sighing to himself, Jim dutifully took a shot. "We just track forces of nature, sir."

"I know it. And I want to understand what that means. I'm not simply here on a fact-finding mission; I wanted to meet the 'Saints' in their natural habitat, so to speak. I've got five quantum physicists on staff at the Vatican, and we've discussed these matters at considerable length. I've been to MIT, and to CERN, where they're trying to catch these miracles in a bottle. But there the issues are academic, not practical. I want to hear *your* opinion. I want to know how you feel about all this."

In a way, Jim could hear two voices coming out of this man. One belonged to Dave Stassi the human being, and wanted simply to connect and converse in the normal way. The other belonged to an ancient organization still immersed in the pomp and stoicism of Rome. *That* voice had to be careful what it said, even to an outsider like Jim. Even on a private channel. A bishop could maybe take a few liberties here and there, but Jim understood that a Pope simply couldn't speak through cute furry puppets, or comment on the merits of Coke over Pepsi.

In a funny way it made him feel closer to the guy, because the same kind of thing had happened to Jim in his transition from bush-league cargo pilot to respectable scientist. Science had its own voice, too, its own list of things that couldn't be said, topics that couldn't be broached. Like communism, science in the real world never actually seemed to occur in its pure form. Its supporters had their own axes to grind, nests to feather, corners to cut, and whatnot. The solemn weight of science had crushed so many prejudices and superstitions already, it was tempting to heave it at anything offensive. But a real scientist was expected to ignore this obvious truth, to at least pretend his aspirations were incorruptible. They *ought* to be, certainly.

What Jim said was, "An informed opinion requires more information than we actually have. It's important to be cautious."

"Obviously," Dave agreed. "I'm not trying to put you on the spot, or compromise your ethics in any way. I'm certainly not going to quote you. But you *have* an opinion, informed or not. Can I ask you to share it?"

Well, that was a harder question to refuse. Reluctantly Jim said, "There are . . . Look, in a star there are competing forces, too. Gravity wants to crush it; heat wants to blow it apart. Neither one is good or evil; neither one is intelligent, or cares about human beings. That's just how it is. In my *opinion*, sir, these decoherence storms are no more purposeful than the radio beacon of a pulsar. Those were very mysterious, too, when they were first discovered. Now we know they're just the field emissions of a spinning neutron star. I think we'll find something similar in this case, and all the people screaming about God will end up eating their hats."

Pope Dave thought that one over. "Did I misread your paper in *Nature*? That comet really did hit the back side of the Moon."

"It was always going to."

"Are you sure? With two competing forces wrestling over it? After eighty thousand decoherence events wiggling its little molecules, you're sure its course remained exactly the same? Is that what you're telling me?"

Ah. This man was cleverer than Jim had given him credit for. And he was onto something, too, in a way. Werner Heisenberg had proven that the trajecto-

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ry of a subatomic particle could never be known exactly, because it simply wasn't exact to begin with. There was a built-in slop factor that would let it jump across gaps, or briefly appear to be in two places at once. Indeed, a lot of electronic gizmos relied on this principle.

Jim answered, "I see where you're going with this. And you know, it's not entirely crazy; if the particles in my little universe were Heisenberg particles—if their positions and velocities had some mandatory uncertainty built in—I could wiggle them around without anyone noticing."

"Except that you'd trigger a decoherence," said the Pope. "You push a particle to the *very edge* of its uncertainty envelope, and you pin it there by collapsing the waveform. For just a moment. Bit by bit, you could move mountains that way. Or comets."

"Yeah. I mean, that's not quite . . . It doesn't really work like that. I know what you mean, and it's . . . well. There's a way to interpret the results which kind of matches your line of reasoning here. Kind of. But I'd be very leery of drawing any conclusions."

"Of course you would."

"Extraordinary claims require extraordinary proof. And you'll never find it."

"No? So we shouldn't even look? Shouldn't even try? That strikes me as the proverbial counsel of despair, Jim. Even if you're right, and there's a little void in the center of science that can only be answered with faith, is that so bad?"

Jim shrugged inside his suit. It was swelling around him, getting stiff, like a blowup doll he'd somehow gotten inside of. "People believe all kinds of things. I don't have a problem with that, as long as they don't come around telling scientists how to do their jobs."

The red light above them finally went out. The green came on in its place.

"EV1, this is Habcom," said Lisa in his ear. "Decompression complete; you're free to open the outer hatch."

"Roger that. Your . . . Your Holiness, just, uh, stick very close. I want you to stay in the lock while I clip your tether. Can you do that?"

"Naturally," the Pope answered. But his breathing was faster, shallower. That was bad, because it would fill his helmet with carbon dioxide, which would trick his lungs into breathing even faster.

"Hold on, I'm going to adjust your oxygen."

Tightly: "Is something wrong?"

"No. You just expend more energy when you move."

Which was true.

"Why aren't you adjusting yours?"

"I will," Jim assured him. "I tweak it up and down all the time. For you, I think it's better to set it a little high. We'll only be out here for a few minutes."

"Oh. Is that all?"

"Sure. Just out to the end of the forward boom, and back, and out to the aft boom, and back again. Then we recompress. We'll actually spend more time in the airlock than we will outside."

Jim went ahead and opened the hatch. Sunlight flooded in, which of course caused His Holiness to breathe harder again. This time, Jim let it go. He'd smoke up his tank pretty fast if he kept that up, but as long as the scrubbers didn't fail the tank was designed to last four hours. No problem there.

Moving carefully, he climbed outside, clipped his tether to the safety wire, and then proceeded to untangle Dave's line from his own.

"I'm clipping you now," he said. Click. "Okay, you're done. You can come out whenever you're ready."

Huff-puff huff-puff. The Pope sounded like he was in the middle of a hundred-meter sprint. His head poked out into the sunlight, then turned to face the glow of Earth.

"My God," he said, then rattled off some prayer in Latin. "Such glory. Such incredible glory." He turned again to face the stars, and the tiny crescent Moon hanging serenely in the distance. Every-

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one said it: the Moon looked smaller from up here.

"We look around us," the Pope said. "Our homes and our cities, our web sites and phones, and we think that's the world. That's creation—God's grand design. We forget the universe that dwarfs us all around."

"Yup," Jim agreed. Here at least he could agree wholeheartedly. Going outside always made him feel that way; it was a great reminder of how small the problems in his life really were. He gave the man a few minutes to look around, to comment in wonder.

"The Moon affects it, too," Dave said at one point. "The phases of the Moon. It seems a funny thing, doesn't it?"

"Something to do with dielectrics," Jim suggested. That was the going theory, anyway. "The Moon is an insulator; it blocks electric fields. When it's new, the Moon is between the Earth and Sun. When it's full, it's out behind us, out of the way."

"And yet . . ." the Pope mused. "It's another foolish old wives' tale, isn't it? Another superstition proven correct. The full-moon crazies. Do you know what I think?"

"No," Jim said, because why would he? "We're going to climb thataway, hand-over-hand. Whatever direction you're moving, it's best to think of it as *up*." Then, to be diplomatic, "You can talk to me while you're climbing. Sometimes it helps people stay calm."

"I'm calm," Dave said, a little defensively.

"Sure? All right, then. Follow me."

They climbed for a few seconds in silence. Dave's breathing quickened.

"You were going to share a theory with me," Jim prompted.

"Right. The Church needs to take a position on these matters. It *needs* to."

"How about, 'no one knows?'"

"Aaah, no. It's my duty to interpret these things. Not just to tell the truth, but to imagine what it means, and pray that that imagination is guided by outside truths. It worked for the Greeks; they deduced the atom. They invented geometry. By clearing their minds and dreaming. Scientists today spurn faith, spurn gnosis especially, but they do so at their peril. Where do they think testable hypotheses come from?"

"Hmm." Jim was going to have to mull that one over. "What's your idea?"

"Well, when I was having my DQ tested, I tried a little experiment: I prayed. And for those thirty seconds, my decoherence rate dropped close to zero. Returned to normal when I finished. I understand meditation has a similar effect."

"I've heard that," Jim agreed. It was anecdotal evidence—no one had done a rigorous study of it yet—but he had no reason to disbelieve it.

"And deeks can't overlap. Something in the construction of the universe forbids it."

"That's true. You doing all right back there?"

"Fine. Thank you." Though his breathing was very rapid, Dave pressed on. "That means free will prevents God from acting. Prevents Him from decohering the space you occupy. Our mere presence deflects miracles."

"Um, okay." That was five times more mystical than it needed to be, but not fundamentally wrong.

"Unless we pray. You see? Prayer is an act of surrender. It quiets the storms inside us, literally creates the opportunity for God to act through us. In exchange for a few moments of our free will."

Jim couldn't help laughing at that. "Ho. Well. That's an interesting belief, sir. But if it were true, your prayers would empower the other side, too. Satan could operate through you just as easily as God. The holiest thing you could do would be to pray on a full-moon Saturday night. That's the most free will you could ever hope to surrender, right? But not to God: to anyone. In theory, even a human being could generate miracles large enough to affect you. Just press your heads together! I don't think so, sir. I re-

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ally don't."

The Pope had no answer to that.

Jim began to feel guilty. Was it his job to demolish this poor guy's belief system? No one had all the answers—least of all Jim Gomez. If you asked him, the whole God thing was a coin toss: the universe *was* rich and complex and *did* give rise to thinking, feeling creatures. Cosmologists insisted this was the result of a delicate balance of fundamental physical constants; tweak any of them even a little bit and the whole thing would have collapsed, or stayed a cloud of hydrogen forever. Supposedly the universe was going to blow up, in like 40 billion years or something, but didn't everything have an end? The amazing thing to Jim was that there should be all this stuff in between.

There was no particular reason it should be so unless (a) there were a very large number of universes, all with different values for those magic numbers, and *this* universe, however rare and wonderful, fell somewhere in the natural range. Or, (b) the whole place had been constructed deliberately, for the express purpose of creating complexity and intelligence. Either answer was fine with Jim, and if someone could devise an experiment to prove it one way or the other, he'd accept it and move on.

Theology was not a real science, but there was a time not long ago when meteorology wasn't, either. You didn't perform experiments; nature did. You could look at other planets, or rare weather events here on Earth, and you could cobble up computer models—Tinyverses grown massive and wildly complex—and throw all kinds of weird conditions at them. But that rarely taught you anything new, and it didn't predict the rain.

But in the Stormbreakers' era every wall cloud was a laboratory, every hailstorm and tornado an empirical indictment of shoddy methods or failing equipment. NWS predicted the weather, yes, and then they *did* something about it. In his younger days Jim had wandered from physics to engineering to pilot school, then back to the ground again when his left eustachian tube stopped clearing properly and made every flight a pain in the ear. He'd found meteorology by accident, while running the clock out on his Air Force enlistment. And *loved* it.

Later, he'd found flying a desk at the Service at least as thrilling as anything the rest of the world had to offer. With the click of a mouse he could fire a hell of microwaves up at the ionosphere, heating and raising it, lowering the barometric pressure underneath and sucking in storms to deflect them from croplands or at-risk population centers. *That* was a miracle. And when he'd turned out to be a "Saint" as well, the Service had dusted off his physics training and sent him right past the weather, to heaven itself.

Looking down now at the Earth, he could see a tropical depression out over the Atlantic, and a cold front rolling its way across the east coast of Africa like a line of cotton-balls aflame in the sunset. The Sun was over America; everything east of Liberia was already in darkness.

"Let's pick up the pace a little," he said to Pope Dave. "The Sun's going to set in a few minutes."

"Oh," said Dave. "Will it be cold?"

"Like winter driving with the heater on. You'll feel the cold, but you won't *be* cold. It'll be dark, though."

He had reached the end of the boom by now. Retrieving the dosimeter was a simple matter of unclipping a bracket, slipping the thing out and into a leg pocket, and replacing it with a fresh one from the same pocket.

"Can you see this?" he asked the Pope. Because even the dullest tasks seemed mysterious and wonderful when you did them in vacuum, with the unblinking stars all around and the lights of Earth flaring beneath you. Jim's first spacewalk—also known as an "extravehicular activity" or EVA—had been with Chip: a repair mission to splice a damaged cable. The thirty minutes they were out still ranked among the most vivid in his life;

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since then he'd done longer, harder EVAs, and they'd all been magic. But nothing could match that first-time intensity. And fear.

"I see," Dave acknowledged breathily. "Thank you."

"No problem, Your, uh, Your Holiness. Now, it's time to go back the other way. Do you want me to climb over you, or would you rather go first?"

"Could I? Lead? I'd love to. And call me Dave, please. I mean that. You're not of my flock; my titles should not compel you."

So they started back. Or started to start back, anyway; as luck would have it the Sun chose that exact moment to slip behind the planet and cast them into darkness.

Said Lisa, "Uh, Jim, I thought you might like to know. Kennet's down in the chair right now running system diagnostics, and she's reading a big jump in activity. A *big* jump."

"Roger that," Jim answered. You couldn't feel a deek, couldn't tell when a boundary condition was slapping you in the face. Not that it mattered, especially. "I'll keep it in mind."

"Whoa," the Pope said, somewhere ahead in the darkness. Then, more emphatically, "Whoa! I'm slipping, I'm . . . I can't feel my hands on the rail!"

Jim reached out and grabbed for Dave's foot, which was right where it ought to be. His eyes needed time to adjust, but to the extent he could see anything by starlight and moonlight, the Pope seemed to be still clutching the ladder, as before. And even if he weren't, the safety wire would catch him. And if that somehow failed, Jim had a jet bottle with him and would effect a rescue. And if *all* of that somehow failed, the whole station could be moved to a slightly different orbit, which would intersect the paths of its wayward astronauts.

In the movies you could lose your grip and fly away forever; in real life you were still co-orbiting with the station, and it would take a big, big rocket motor to get you up to escape velocity and off into deep space.

"It's vertigo," he said, in his best EVA-buddy tone. "Just close your eyes and breathe deep. Lisa, kick on the floodlights, please."

They *should* have come on automatically, but with the shuttle drawing power from the station's batteries, maybe the power management system was trying to cut corners. For good measure, Jim flipped on his suit's own headlights.

"Oh. Damn," he said a few moments later.

After that, everyone tried to speak at once.

"Help! *[puff, puff]* Jim, help me!"

"*Papa, stai bene?*"

"Floodlights inoperative. We may have tripped a circuit—"

"—falling—"

"—*cadendo?*"

"—twisted in the wire or something—"

"—your status. Please advise—"

"*Ich wusste, dass wir nicht ihn draussen gehen lassen sollten.* Help him, idiot!"

Jim tried three times to get a word in, but the channel was bursting with traffic. The Pope was a mess, too, struggling in the jumping shadows of Jim's lamps. He'd fallen forward into a loop of his own tether, then tried to jerk free or something. Then things had gone really wrong, and now he was tangled so badly that his arms couldn't reach the rail. He had one boot tucked underneath, and he was pretty much dangling by that, and reaching in vain for a handhold.

"Clear the channel," Jim said, repeating it five times so it had some chance of getting through. Then: "Dave, you're all tangled up. Hold still, please. Hold still. I've got your foot."

"The lord is my shepherd, I shall not want. He maketh me to lie down in green pastures . . ."

"Be quiet, please."

"He leadeth me beside the still waters . . ."

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"Stop it!" Jim said, shaking the Pope's foot for emphasis. "You're not going to fall away. Do you hear me? You're not going to fall away. You *can't*, and if you somehow do, I'll catch you. Okay? Just relax."

"Sorry. Sorry."

"Just relax." Jim moved as far forward as he could without getting his own tether's carabiner caught up in the tangle. Examining the situation, he bit back a curse. Because to unravel this puppy he was either going to have to roll the Pope a few revolutions to port, or he was going to have to unclip the harness. In fact, he'd have to unclip it anyway. Damn. That did make a bit of a safety problem. Still, the worst thing to do in a crisis—even a minor crisis—was nothing at all.

He moved forward a bit more, getting his head and shoulders up over Dave's feet, then unclipped the carabiner. Without saying anything, he unwrapped it from around Dave's oxygen pack, then solemnly wound it underneath him until he could free the loops around the pontiff's arms.

"I'm slipping," Dave said at one point.

"I still have your foot," Jim assured him. Of course, he was working one-handed and hanging on by his own toes, but he saw no need to bring that up. Just two more turns, pulling the carabiner through here and through there . . . and it was done.

Except that Jim's own tether, floating loose and slack, had gotten mixed in there somehow. Now *it* was looped around the ladder and knotted to itself, and how the hell had *that* happened? Dave's wire was wrapped up in it, too. It was like a bloody miracle, this ability of strings and wires to snarl themselves without help. The thing was probably just two quick moves from freedom—a pull here and a tuck there—but which two moves? Jim couldn't see them. So, sighing, he unclipped his carabiner as well. Twist, twist, and now both cables were free, as easily as that.

"I'm *really* slipping," the Pope warned.

Jim was just about to hook the two carabiners back onto the guide wire when Dave suddenly lurched, and twisted, and floated free of the ladder. And so did Jim.

And suddenly Jim was terrified, because he and the Pope were tangled up in a knot of their own—a human knot—and they were a meter from the ladder. A meter and a half. Two meters!

"The lord is my shepherd, I shall not want . . ."

"Quiet. Please."

"He maketh me to lie down in—"

"Shut it! That's not helping!"

But the Pope couldn't hear him. Now they were spinning a little, too, and the ladder was still retreating from his grasp, centimeter by centimeter. Damn! Making no effort to hide his curses now, he grabbed Dave by the backpack and rotated him firmly out in front.

"Hold still, hold still!" he growled. Why was he so scared? He knew exactly what to do, and even if he somehow panicked completely, Lisa was guiding the station, and *she* knew what to do.

Indeed, Lisa's voice cut briefly through the channel with, "—whether you require assistance, EV1."

"Negative, negative," he tried, his voice tight with fear.

The Earth and stars wheeled by slowly, and when the rotation had brought them back around again, Jim hurled the Pope back toward the ladder, not hard but firmly. Dave floated back in a straight line, sans rotation.

"Aaah, grab on tight!" Jim commanded, repeating that several times to make sure it got through. And whether Dave heard or not, he surely complied, grabbing the ladder hard in his gloved hands the very moment he could reach it. He then surprised Jim by retrieving and inspecting his tether cord, sliding his hand up to the end, and clipping the carabiner back on the guide wire again.

"—you all right up there?" someone asked around a burst of static.

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"Just shut up for a minute!" Jim snapped. Per Isaac Newton, that push to Dave had just added half a meter a second to Jim's own velocity; he was getting farther, faster. Still, there was little question what to do next. Working slowly and carefully, he got out his jet bottle and took a *very firm* hold of it against his center of mass. If he lost it now he was screwed, so he cradled it, aimed carefully, and waited for his moment. When it arrived, he pulled the trigger for nearly a full second.

Jim had never seen the plume of a jet bottle in hard vacuum before. It surprised him, blowing in all directions like a fountain made of white fog. Some of it even came straight backward, striking his faceplate and bouncing away in straight lines. But it did the job; his rotation sped up a little, but his linear motion had reversed.

The floodlights were finally on, so even with his lamps pointing off to nowhere, he could clearly see he was just twenty meters from the station—still too close to take in the whole thing at a glance—and he was moving toward it. Almost exactly toward it.

He was going to hit with his back, though, so he pulled his knees in and rotated his arms, swiveling like a high diver or a dancer. Or an astronaut. This did nothing to kill his rotation, but it turned him around so the timing was right: he would hit the ladder arms-first.

"Bravo!" said the Pope, looking up at him.

Jim said nothing, waiting for the slow-motion collision that would bring him back in contact with the ladder. When it came, he grabbed on and, like Dave, got clipped to the wire again as quick as he could.

"So calm. We were never in danger at all," the pontiff marveled.

At which point Jim disappointed himself by answering, "Bite me, jerk. You just about screwed us both. Don't ever do it again."

To the Pope himself, yeah. Not the sparkliest moment in his lifetime, that. He clung there for half a minute, getting his breath back.

"Aaah, I can see you," Lisa said from the command cupola. "Looks like you're all right. Can you confirm?"

"Roger that," Jim puffed.

"You still have the other dosimeter to retrieve," she said apologetically.

Surprisingly, it was the Pope who answered that one: "I'm up for it if you are, Jim. It's gorgeous out here. Is that Madagascar? Who'd've thought it would need so many lights!"

4.
The Human Element

So far as the laws of mathematics refer to reality, they are not certain. And so far as they are certain, they do not refer to reality.

—Albert Einstein, 1947,
"Geometry and Experience."

In theory, there's no difference between theory and practice. In practice there is.

—Yogi Berra, circa 1980

They had a big feast that night, with Chip and Robert doing most of the cooking and Jim doing most of the cleaning up. Dave and the Swiss Guard were still looking a bit green and didn't eat much, and at first the setting was quiet. Having the Pope over for dinner had made everyone shy, and the near-accident this afternoon had knocked a bit of the stuffing out of them, too. It could have happened to anyone, and it could have been bad.

But the silence ran deeper than that. For six months, Dewey Park Station had been home to five people—its very first tenants—and though they'd enjoyed good contact with the ground—by email, by phone, by video conference—they'd become a pretty tight little society up here. More so than Jim had realized; having any strangers at all here felt really

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weird, really cramped. Like hosting a dinner party in your car.

It must be strange for the new crew as well. They'd been training together for six months, but mostly during the daylight hours; afterward they'd gone home to their families. This was probably the first night they'd all spent in the same place. And it was an unfamiliar place, too; they would have spent time in the Franklin mockup at Offutt Base, but a lot of the systems there were fake, or modeled after the other two stations, which differed from Dewey Park, and from each other, in small but meaningful ways. And there was no gravity here; that made a big difference all by itself.

And then there was the privacy issue: Jim and company would be moving out of their cabins in the morning, except for Robert, who offered to cede his to Pope Dave tonight and sleep instead in the command cupola. Everyone else would be sleeping in bags out here in the wardroom, or on the shuttle, or (if they really really needed the quiet, and didn't mind the cold) in one of the airlocks. It was a camping trip with an unfamiliar crowd.

So here the new crew was, watching the old one go through their dinnertime paces with practiced ease. Dealing with spills, with errant food particles, with appliances and utensils and power management systems . . . Jim could see it in their eyes: it was a lot to take in, and they weren't completely sure they could handle it. All this and danger too! They were happy to be here, yes, but a wee bit overwhelmed.

Still, that was life in the Service. Pope Dave broke the ice by saying a short grace in English, and Lisa followed with a story about her husband, a chainsaw, and a bolt of lightning that had flashed out of a mostly clear sky. It wasn't a funny story per se, but she laughed while she told it, and by the end her giggles had infected everyone but the Swiss Guard, who probably understood English but were good at pretending they didn't.

Then Robert launched into one of his Stormbreaker tales. "At twenty thousand feet you have *time* to respond when a microburst hits, but it'll take your breath away. Suddenly your air speed is a hundred kilometers faster, and aimed at the freaking ground. The good part is, you're falling along with the hailstones so your chance of a windshield strike is smaller. But there was lightning crashing around us as well, and in the darkness it was blinding. Just blinding.

"Anyway, wouldn't you know, our load of CloudKill powder just wouldn't deploy. I'm, like, pulling the handle over and over, because I'm ready to get out of there, but there's ice in the vents or something. So I'm screaming at Howard to kick on the heaters, kick on the heaters, but Howard's tossing his dinner all over the cockpit. It took me five whole minutes to break the center out of that anvil and climb away, and truthfully I'm not sure the plane ever flew again. I bet the wings'd fall right off."

"Cool," someone said.

Jim didn't have any stories like that. There were a few close calls in his air tanker days, but nothing that really made for a good anecdote. He had his own vivid memories of the storm in question, but he'd been working the ground side of the operation. Just as critical, but the drama of it was harder to convey.

He toyed with the idea of telling his Pope joke, but thought better of it, and settled instead for an account of the EVA slip, heavy on detail and light on emotion or judgment. People were curious about that, and the details were still fresh in his mind. Fortunately, no one seemed particularly to blame him, or Dave, for what had happened. Which was good, because Jim wasn't sure himself whether he'd been brave, stupid, lucky, unlucky, or just plain careless. Or maybe victimized by a sadistic miracle?

"You saved my life," the Pope had said, a few minutes after it happened.

"I *endangered* your life," Jim had cor-

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rected.

"No, I did that myself: went outside in a quantum storm without knowing what I was doing. You're not responsible for my choices."

Ah, but what about his own? Jim had long suspected he was a bad decision maker. Sure, he'd landed one of the coolest jobs on Earth, which in turn had gotten him *off* Earth, but the separation had apparently cost him his family. Not that he and Carla had been doing all that well beforehand. More bad choices, in the face of bad events dished out by the world. Could he have handled it differently when Rachel got sick? Were they all doomed from the outset?

Fortunately, Chip saved him from further thought on the matter by hauling out his guitar and playing a couple of songs, during which a pint of Scotch whiskey appeared as if by magic, and made the rounds, disappearing almost as quickly. Even the Pope had a snort, though his guards did not.

Then for a few minutes Dave was off in a corner, talking with the guards in low tones, and then one of them went down to the shuttle and never returned. Then finally, inevitably, the conversation turned toward matters religious. Had Dave ever been a cardinal? Had he known he was a candidate for Pope? Where was he when they first told him he'd been elected? These questions were duly answered: No, Heck no, and buying a pair of shoes at a store in Philadelphia.

More questions followed, involving God and Jesus and even more obscure issues, like sin. Jim had no interest in these things, and was suddenly feeling unaccountably low, so he floated off to his cabin and slid the fanfold door over until it latched. He would call his family, such as it was, and let them know he'd be home soon. Not to stay, alas, but to say hi and pick up his things.

Unfortunately, the call went poorly, and ended with shouting. In a more philosophical mood he might've mused on the intertwining of love and pain; the people who brought you real distress were the ones you built your life around. And they were the ones *you* hurt in turn. In a perfect world there'd be no force stronger than love. In a world where little girls needed brain surgery and two-income families went bankrupt, things were more complex.

"I love you, Rachel," he told his daughter, trying not to look too sad. Trying not to see her scars. Trying hard to believe her when she smiled in that funny new way of hers and said, "I love you, too, Daddo." But where exactly did love reside? Did losing half a brain have perhaps some small impact on a person's feelings and memories? The girl who'd recovered from that terrible surgery was not the one who'd lain down for it. *That* girl was dead, and Jim knew in his heart that by agreeing to the procedure, he'd helped kill her. Of his own free will?

"I need to talk to your father," Carla cut in at that point, her voice cold and angry.

"Hey, Sweets," Jim tried. "How's MalevoLink?"

"LeverLink!" she snapped, moving her angry face into the picture. "That's LVLK on the Nasdaq, Bub, up fifty points this morning alone. Anything else you want to trash while we're at it?" And things had gone downhill from there.

By the time Jim hung up his shoulders were cranked bowstring-tight; his fists were clenched and looking for something to punch. But even his bed, even his pillow, would shake the whole station. What he really needed was a long, cool walk beside the Platte River, or at least a quick run around a track somewhere. Here, the best he could manage was a jog on the treadmill with his body held down by rubber bands, and if he did that the noise would drown out most of the wardroom's conversation. Still, with the emotion boiling inside him he found his cabin too small, too confining. If he stayed in here, he *would* smash something.

Damn! How had he ever loved that

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woman? And why did he love her still, even now? She'd never understood his Rachel feelings, much less condoned them, and the money woes had stolen away the last of her charm, leaving nothing of the saucy 23-year-old he'd long ago fallen for. In all the ways that mattered, she seemed to be dead as well.

With a sigh of disgust, he unlatched his door and yanked it open only to find, for the second time that day, the face of Pope Dave waiting for him on the other side.

"Oh!" said Dave.

Jim sighed again. "Hi. Sorry. Did you hear any of that?"

Dave offered an apologetic look. "I think the whole station did. Is there . . . anything I can help with?"

"No." Well, that sounded bad. Ungrateful, undiplomatic, unprofessional. "I mean, thanks for offering, but some situations are beyond repair."

"No pain is beyond repair, Jiminy."

Jim flashed him an angry look then, and said in a low voice, "Don't give me any of that Pope routine, all right? No offense, but you're brand new in the job."

"I've been a priest for thirty years," Dave answered without rancor, "and a bishop for four. I've seen a lot of things. Every situation is unique, but pain feels the same for everyone."

"Uh-huh."

Dave dropped the subject as easily as he'd taken it up. Instead, he fished in his pocket and then held out a silver coin or medallion of some sort, in a clear plastic case. "I stopped by to give you this, as a token of my thanks."

"For putting you in harm's way? And yelling obscenely?"

"For taking me outside. You had your doubts, and rightly so, but you did it anyway, at some risk to yourself. Also for talking with me, for letting me observe your scanning session. You've given me a lot to think about, and whether you take that seriously or not, it'll affect the lives of a billion people."

Jim looked down at the medallion. One side bore a chalice and some Latin writing, the other a picture of David Wayne Stassi himself, with the words "DAVE I" and a date underneath.

"Keepsakes like this are one of the perks of the office. I worry about the vanity of it, but as an encouragement to good works they do seem useful. They've also been specially blessed."

"By you?"

"That's right. Believe what you like about it; this is something tangible I can give you."

Jim hefted the thing. It was heavy: a full troy ounce of silver, or maybe forty grams. The embossing was nice as well; where the coin didn't shine like a mirror, it had a frosty, marbled, rainbowy kind of look to it—some kind of subtle hologram thing. Computer-generated microtexture? The portrait didn't move or change in any overt way, but there was an animated quality to it nevertheless. Mint condition, probably never removed from its package.

"Um, thank you," Jim said, brought up a bit short by this. The thing was probably worth a thousand bucks, and worth even more as—yes—a memento of this strange encounter. "Always happy to do my part."

The Pope paused for several seconds before asking, tentatively, "May I offer you some advice?"

"Sure," Jim said. Why not? The cardinals had presumably picked this guy for some reason; he certainly wasn't stupid.

Dave put his hands together and said, "Trust."

Hmm. Was that it? "Trust what?"

"Yourself. Your wife. Your feelings. The laws of nature."

"Trust in God?" Jim asked, oozing skepticism.

But the Pope's answer was mild. "Absolutely. To you, God is just an idea. A symbol that stands for a lot of complex things. My advice is, trust him anyway, because the things he stands for are worthy. Clear your mind, Jim. Try praying. The very worst that could happen is, it

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won't work. Then again it might surprise you with answers and insights, mysterious bouts of good fortune . . . We may not grasp its full implications yet, but there's a quantum-mechanical basis for believing."

At that, Jim couldn't quite help rolling his eyes. "Believing came first. You're just here to confirm what you think you know."

"Like the atom," Dave agreed. "Absolutely. And here's a little something for *you* to think about: the President sent Stormbreakers up here. Not chasers, not trackers, not patient data collectors."

"We are collecting data," Jim said. "Patiently."

"Oh, I know," the Pope agreed. "No offense intended. But your very presence here has an inhibitory effect. How many hypercones will never reach the ground, because your own thoughts keep them from forming? You guys are the barrier island on which God's storms can break."

Oh, so it was like that? Angrily Jim said, "You're here to shut us down? We're blocking your heavenly reception? Shit. You can take back your stupid medal, Dave."

He handed the thing over, but the Pope just looked at it, refusing to reach out. "Jim, I'm not your enemy. Really. The stuff you guys are uncovering here could change the world. Think of all the wars, all the genocide we see in the name of religion. What if we *knew*? What if we could map the will of God? Whether you choose to believe it or not, you and I have the same goal: the truth."

"Yeah?" said Jim. "Really? What if the truth doesn't match Christian doctrine? If all the little holes don't line up perfectly, you're not just a radical Pope. You're a *heretical* one, and they'll nail you to a cross for your trouble."

Dave just smiled. "Me? I'm a puppet show guy from PBS." Then he did an odd thing, pressing the heel of his hand against the middle of Jim's forehead, not quite hard enough to push him back into the cabin. "Blessings of the Lord be upon you. Sleep soundly tonight."

And it was probably just hypnosis or something, but Jim felt a slight buzzing sensation and remembered nothing more after that until he awoke, snug in his bag-bed at 06:30 the following morning, with a dream of fragrant roses leaching away through the corners of his mind.

5.
A Fire in Heaven

The proper season is when the weather is very dry; the special days are those when the Moon is in the constellations of the Sieve, the Wall, the Wing or the Cross-bar; for these four are all days of rising wind. A wind that rises in the daytime lasts long, but a night breeze soon falls.

—Sun Tzu, circa 300 B.C.,
"Five Ways of Attacking with Fire."

Mission Control was unaccountably understaffed; three of nine people had failed to show up for work, and their backups took forty minutes to plug in and come up to speed on the mission details.

"Is there a plague?" Robert wanted to know, grumping into his headset microphone.

"Just a gorgeous July morning," the capcom officer on the ground had answered. He sounded like a kid, and nobody on the station seemed to know who he was in more than a recognize-the-name kind of way.

Anyway, this put departure ops nearly an hour behind schedule, which necessitated all sorts of rushing around. There wasn't much time for sappy handover sentiment, or for proper procedural training. In six months the station crew had settled into a very efficient routine, which they'd had little chance to run through with the new crew. Galley power off *before* you switch the water heaters on, etc., etc. But if they missed

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their landing window it would be another full day before they could get out of here, and nobody seemed willing to consider it.

"Take care of her," was pretty much Robert's sole instruction to the new commander.

Jim, for his part, told Kennet to call his cell phone if she needed anything. The phone didn't work up here, of course, but once he was on the ground—or even near it—he'd be back in that part of the world again. The Noosphere, Tielhard had called it. The buzzing atmosphere of information that surrounded the planet, thicker and thicker every year.

Amusingly, Pope Dave had a heavy-looking satellite phone that *did* work up here. He spent several hours yakking into it in Italian while the crew rushed and fussed around him. "I'm told this thing would work on the Moon," he remarked to Jim at one point, covering the mouthpiece with his hand. "It's secure, too; heavy encryption. Pretty cool."

Hmm. Perks of the job. "The chicks must love you," Jim answered, then caught himself. He'd just zinged the Pope. A regular-guy kind of Pope, to be sure. Easy to talk to, all that. But a billion people did look to him as their spiritual leader. Would Jim talk to the President that way? To a movie star? Probably, yeah, but he ought to watch it just the same. The Swiss Guard didn't like him already, and made no particular secret about it.

Finally it was time to seal the hatch, to isolate the atmospheres, electrical systems and computer networks of the shuttle and station. Jim and Chip walked through the steps together, each making sure the other hadn't left anything out.

"Some Russians died that way," Chip noted. "Left a valve open and suffocated."

"Pretty crappy valve design," was Jim's answer to that. General Spaceplane did a much better job of idiot-proofing. Still, since idiocy was one of the universe's truly limitless resources, he trusted nothing and triple-checked everything.

"*No, no, vi ho detto*," the Pope was telling his guards when Jim and Chip worked their way back to the mid-deck airlock. "I'm not riding in that thing. I want to *see*."

"See what?" Chip asked.

"Reentry." Dave jerked a thumb at the pair of jacks behind him. "These guys expect me to sit in the escape pod the whole time. There isn't even a monitor screen. I spent the whole launch sequence in there, and never saw a thing until we were already in orbit."

Hmm. Jim had seen that escape pod—was in fact about to check its circuit breakers and air vents—and he wouldn't want to ride in it, either. It was a two-seater only slightly bigger than a Mercury capsule, or a really compact sports car. Still . . .

"Reentry's the most dangerous part of our flight profile, Dave, and this is clearly the safest spot on the ship. It would look pretty bad for the Service if anything happened."

The Pope considered that unhappily. Here was his one and probably only trip into space, and he couldn't look out the window? "I'm here as your guest," he allowed. "Naturally I'll follow whatever course you recommend."

Hmm. Yeah. "We can tie the door open with a bungee cord," Jim suggested. "From here if you . . . if you lean forward and crane your neck you should be able to see the mid-deck monitors. That's all *we* have to look at, me and Tomo and Chip. This isn't a tourist ship. Your guards can ride up in the cockpit, where the actual windows are."

"*Nein*," said one of the jacks in a thick European accent. "One in the cockpit. One in the pod with His Holiness. I insist on it."

That was no skin off Jim's nose either way, so he ran the arrangement by Robert and Lisa, who approved it without complaint. So, five minutes later when the systems were duly isolated and

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crosschecked, he strapped himself into the seat immediately forward of the pod, with Chip on his right and Tomohiro on his left. "Ready?" he called back to Dave and the guard.

"Whenever you are," the Pope confirmed. Boy, he did look cramped back there.

"Mid-deck ready," he said into his headset, pressing the push-to-talk.

"Aaah, roger that," answered Lisa, then rattled off a string of numbers for the benefit of Robert or Mission Control or somebody.

And then, with surprisingly little fanfare, they detached from the station, drifted away for a minute and a half, then fired a series of bursts on the attitude control motors, to turn the shuttle ass-backward in its orbit. They were behind schedule, so a whole series of checks and rechecks were skipped, while the pilots went straight into the deorbit routine.

"Point-three gee burn, eleven minutes nine seconds duration," Lisa said, presumably reading the figures off one of her displays up there. "Ignition in three minutes forty-one seconds."

"These are going to be a long three minutes," Dave noted, not over the headset but just calling forward.

But they weren't, really. Much longer was the deorbit burn itself, with the unfamiliar tug of gravity—or acceleration, anyway—on their bodies, on their chests and faces. They were all on the best gravity drugs and had kept to the exercise regimen so their bones and muscles didn't wither. Even so, after six long months of zero-gee, the pull of anything on your body felt more than a wee bit suffocating. Jim felt it most in his throat—a squeezing sensation, a feeling that his windpipe was no longer round, but some sort of oval. At point-three gee! They'd be pulling five times that much in a few minutes, when the shuttle turned around to face, nose first, a wall of gluey atmosphere at bone-searing temperature and speed.

The burn wasn't loud—just a hum and roar, like the sound inside a moving car—but nobody much tried to talk over it. When it was finally over, though, Jim turned and looked back into the pod.

"You okay back there?"

"Perfectly, thanks."

And as it happened, these were the last clear words ever spoken aboard that ship.

Death comes upon us in strange ways, shockingly sudden and disarmingly weird. Even months in a sickbed can't really prepare us for what's to come; the event arrives on its own time and terms, and everyone is caught off guard. Living one moment, struggling the next, and finally just gone.

There was no contrail. There was no explosion. Initially at least, there was no debris. Whatever you might have heard, it wasn't a missile. But there was a sudden streak of ionized air molecules, here in the wispy tendrils of the upper, upper atmosphere. As near as Space Command was able to figure it, the shuttle *Oberon* was struck by an anti-satellite energy weapon—most likely a hydrogen-fluoride laser based somewhere in central Asia. The Free Will Index was very high in that region; the choice to fire was made deliberately.

Shall we imagine human malice reaching out through a window of favorable weather? Shall we speculate on an agenda furthered, a To Do box checked off, a connection to the disappearances of NWS staffers in Omaha? Perhaps God or some other force could have intervened, or (troublingly) perhaps it *did*, in planting the seeds of these events. But the telemetry is clear enough: the beam passed completely through the fuselage in a tenth of a microsecond, unimpeded, leaving two fist-sized holes.

Jim's own perception was more muddled; one moment everything was fine, and in the next there came an orange flash and a loud noise, like the popping of air-filled bags. Bang! Bang! And there was a fierce wind, and sharp bits of

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something flying all over the place, and everyone was screaming.

The strangest property of accidents is the way we perceive them: not as movies, but as comic books. "It happened so fast. It happened so slow." People say both of these things, and mean them, because the event breaks up into a series of discrete, vivid snapshots.

Flash: Jim was somehow out of his seat, and looking aft at the escape pod, and the Swiss Guard was there with a panicky look on his face, trying to pull the hatch closed and punch the fuck out of there. But the hatch was bungeed open.

Flash: Something lurched, hard, and suddenly Jim was back there on the pod, falling against the door in some kind of weak gravity. He was trying to draw a breath from the roaring air; he was hot and cold and hotter still.

Flash: the guard, in his space-jack flightsuit, was rolling up out of his chair and grabbing at the bungee cord, realizing the hatch wouldn't close until he somehow untied the thing.

"You're panicking," Jim wanted to tell him. "Just slow down and watch what you're doing."

But the words wouldn't come, and the part of Jim's brain that composed them was at the back of his skull, somehow—, a passenger watching quietly while Jim himself panicked and thrashed. He wanted to help with the bungee cord, but that desire didn't seem to connect in any way with the actions of his body.

Flash: Finally, somehow, the bungee cord was floating free, and the Swiss Guard was bouncing away on a trail of jiggly blood spheres, and a hand was reaching out and hauling Jim into the pod. But whatever was happening here, Jim hadn't wrapped his head around it yet. He resisted, then actively fought. *Get off me, let go,* a part of him thought.

And then there was fire, and the ship was breaking up around him, and that clear, quiet part of his mind was noting, with absolute calm: *Could use a damned miracle right about now.*

Said a voice from the ground, "Track loss, track loss. The radar filter has multiple targets. Oh my God. Does anyone have lock?"

But no one did.

"Seal the mission control doors," said the flight director. "Call security. Get me a next-of-kin list. *Nobody* talk to the press."

But everyone did.

A sad story? A martyrdom in the grand tradition? This is what happens, sometimes, to those who can't leave well enough alone. As it turned out, though, the escape pod fell away with two bodies sealed and rattling loose inside. Parachutes? Barely. No radar saw it come down. But the conspiracy theorists will tell you: the Pope and the Weatherman survived their fall and are still out there somewhere, arguing about God and Heisenberg while they make their slow way home. And truth be told, in a world of provable miracles, stranger things have been known to happen.

But really, who's to know? Where such miracles hide in the shadows of quantum mechanics, they must work—by definition—in subtle and mysterious ways. And that's a good thing, right?

6.
Strange Waters

In our notebooks we were instructed to write the names of our top five choices, but when I finished, I saw to my amazement I had written "David Wayne Stassi" five times. Mind you, this was a man I'd barely heard of. "Smetta di scherzare," *said Carlo Dallabetta, who sat to my right. Quit clowning around. But I noticed he had done the same thing, as had Michal Wonarowicz to my left. It looked peculiar, I'm the first to agree, but three polygraphs later, the College began to realize this was no ruse, but a message.*

—Cardinal Albert Ryan, 2012, "That Election" ■

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Science Fact

The Shape of Wings to Come

Alexis Glynn Latner

You'd be surprised how much you can do without an engine, on Earth and elsewhere!

The year 2003 marked the 100th anniversary of powered flight. Amid the celebrations, there could be detected an undercurrent of regret in the hearts of many aviation buffs, a sense that all the great aviation milestones were history, alas. You can still go a bit higher and a bit faster . . . but tweaking existing records doesn't satisfy like carving them out of the air in the first place.

Yet in December of 2003 a sailplane pilot named Klaus Ohlmann won the Kuettner Prize for surpassing 2,000 kilometers in a straight-line flight. The prize had existed unclaimed for twenty years after it was established by Joachim Kuettner, one of the grand old men of aviation meteorology, who set the goal at 2,000 kilometers (about 1,200 miles) because it takes riding a jet stream in the lee of a mountain range for a sailplane to go a great distance in a straight line, but jet streams are only about 1,000 kilometers wide. Someone had to find two jet streams close together. Ohlmann went 2,174 kilometers in thirteen hours above the snow-streaked peaks of quiescent Andean volcanoes. It was silent flight the whole way, no engine, just the whisper of cold air slipping along the smooth, white fuselage of the Nimbus 4DM sailplane.

No more grand aviation milestones?

Sailplanes and aircraft that glide at least some of the time are doing wondrous things lately. In 2004, SpaceShipOne visited and revisited the edge of space, rocketing up past 62.1 miles, or 328,000', then gliding home. It's registered with the Federal Aviation Administration as an experimental glider.

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Meanwhile the Perlan Project is using sailplanes to explore little-understood stratospheric waves near the North and South Polar ends of the Earth's atmosphere. Sailplanes are sleek vectors into new atmospheric frontiers on this world, and other worlds too.

Before the Beginning

It all began back when Earth itself was a different world—the world of the supercontinent Pangaea and the flying dinosaurs, the pterosaurs. Pterosaurs could flap their wings, but larger species like Pteranodon must have spent much of their time in gliding mode. It's the most efficient way to fly, and not limited to going down. Air rises under many circumstances. A sufficiently capable flyer can rise with it.

The largest and latest pterosaur was Quetzalcoatlus. This ancient beast had a 40-foot wingspan. That's more wing than the typical Cessna 150. Any flying dinosaur that large had to spend most of its airborne time in gliding mode.

The first bird, Archaeopteryx, dwelled on Jurassic shores and probably did some of both flapping and gliding. What Archaeopteryx probably did *not* do was crawl up into the trees and learn to fly on the way down. For one thing, there weren't tall trees yet, just ginkgoes and palmlike cycads. For another thing, the most likely outcome of early flights off high perches would be dead protobirds. The great issue in flight is controlling movement in three dimensions, hard to master in a few seconds of free fall. Archaeopteryx must have done as the pterosaurs did, and young sea birds do now, and it's not a bad way to learn to fly: inhabit a sandy shore with a strong sea breeze, where outstretched wings produce enough lift to glide for short distances, ending at worst in a tumble into the sand. The history of avian evolution is probably not recapitulated in the baby songbird taking the plunge out of the oak tree. The species, if not the baby, long since solved the problem of control. (1)

Ages later came the hawks and vultures. These birds circle on outstretched wings in thermals: air that bubbles up from sun-warmed terrain. If the local air is sinking, raptors flap if they must, but prefer to scrunch their shoulders and make a fast glide to the nearest parcel of air on its way up. Why flap when you can glide over to a good place to soar?

The supreme gliders of nature are the wandering albatrosses. They have long, narrow, pointed wings, which they can lock into the outstretched position. Since they weigh twenty pounds and more, near the theoretical maximum for flying birds of their size, launching entails a long sprint with wings flapping hard. But once aloft, their weight is an asset, because it maximizes the aerodynamic efficiency of their flight. (For things that fly, less weight is generally better: that's why bird bones are hollow and aircraft engines are made out of aluminum. On the other hand, a heavier bird or aircraft will have a higher most efficient speed, allowing it to fly faster and further with minimum expenditure of energy. For that reason, racing sailplanes carry water ballast. It gives them a competitive edge—and they can dump the water if the added weight becomes a liability.)

Wandering albatrosses are old masters of dynamic soaring, an exciting new concept to humans. It means taking energy from the wind to maintain flight. "By heading into the wind and gliding upward from the slow-moving layers of air nearest the sea's surface into faster-moving layers above, the albatross maintains its lift and airspeed without moving a muscle. At the height where the airflow ceases to increase with altitude, the bird changes its strategy. Tracing a ninety-degree arc, it glides back down toward the sea, across the wind, accelerating until, on approaching the wavetops, it once again turns into the wind and uses the wind's energy to climb. The bird can continue this indefinitely,

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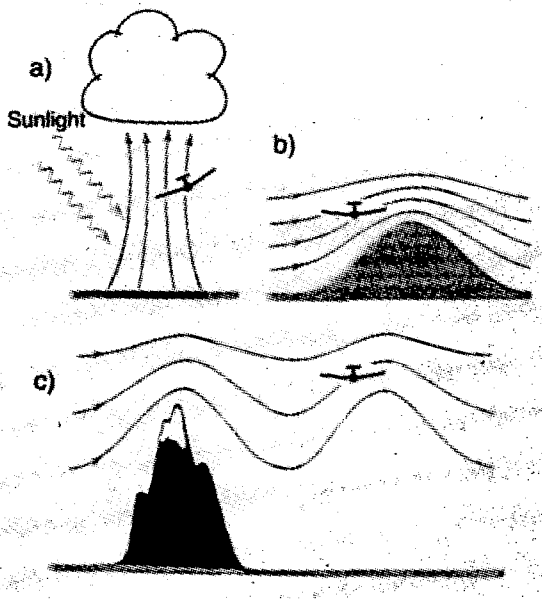

Illustration 1. Sources of lift. (a) thermal (b) ridge lift (c) mountain wave (Courtesy F. Barry Dunning)

even for days at a time, tacking upwind without ever flapping its wings. Only the most efficient gliding aircraft, with ultralong, narrow wings, can outperform the best albatrosses." (2)

Flying Machines

Beginning as arboreal mammals whose only flight consisted of jumping from one branch to another, humans are johnny-come-latelies to the sky. But what we lacked in evolutionary focus, we made up for in enthusiasm. We dreamed up legends like Icarus, and we fantasized about flying machines, some of which were actually constructed. Around the year 1000 CE the monk Eilmer glided the length of two football fields before crashing because his contraption lacked a tail to provide lateral stability. (3)

A hundred years ago, the Wright Brothers methodically tackled the problem of aerodynamic control. Experimenting with gliders first, they launched off sand dunes into stiff sea breezes. Not many years later they were flying around the Statue of Liberty in their aeroplane, but they continued gliding too. Orville Wright set a gliding duration record of 9 minutes, 45 seconds, in 1911 in the Wright Glider 5 at Kitty Hawk. (4)

While fervor for powered aircraft seized the human imagination in the early twentieth century, gliders too became more capable, their pilots more canny. Gliders always fall. If, however, you stay in rising air, you can gain altitude. It turns out the world is full of rising air.

At the end of World War I, the victorious Allies prohibited power flying in Germany. So the German government subsidized glider operations in which daring young pilots learned the ways of the sky. Initially they explored how wind interacts with hills and ridges. When wind blows against a ridge, it tends to be deflected up. With a steady wind, skill, and luck, a glider can fly back and forth along a ridgeline. (Illustration 1)

A glider first soared on a thermal in

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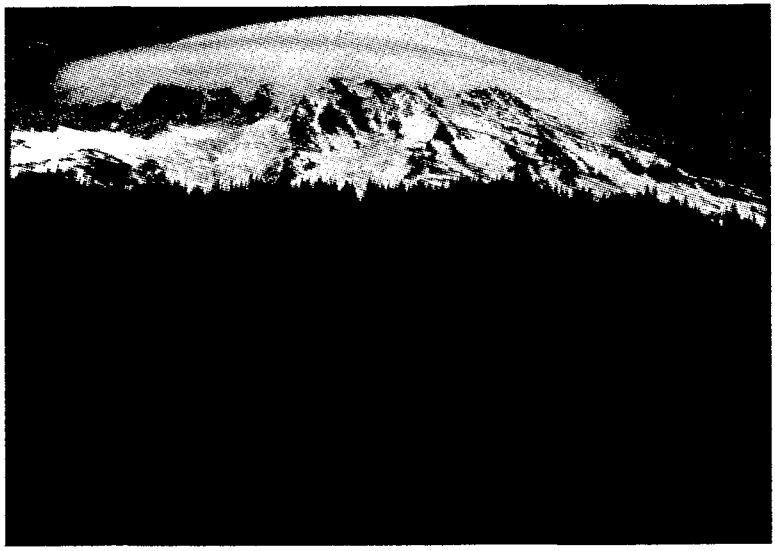

Illustration 2. Altocumulus lenticularis over Mt. Rainier. (Photo by Joyce Schmidt)

1926. Conveniently, thermals are often marked by cumulus clouds where the rising bubbles of air reach the altitude where water vapor condenses. Using thermals, the German glider pilots were able to break free of their ridges and strike out across the countryside. They would circle under a cumulous cloud, gaining altitude, and then glide to the next cloud and regain the altitude lost in the glide.

Then the German pilots found a massive atmospheric mechanism that no one had even dreamed existed. Wind blowing over a hill, ridge or mountain range falls downward *and bounces back up*. It descends again, and bounces up again, and again: a standing wave. Sometimes the wave crests are marked by flying-saucer-like lenticular clouds. (Illustration 2) Joachim Kuettner, then a young German doctoral candidate in meteorology, analyzed mountain waves both theoretically and experimentally. He achieved a world record soaring altitude record of 22,300' in 1937.

Military gliders had a role in WWII. Some transported men and equipment. Others were used in flight training. After the war, Joachim Kuettner relocated to the United States to practice his trade as a meteorologist. He took a leading role in the Sierra Wave Project in the 1950s. East of the crest of the Sierra Nevada Mountains, when winter winds blow from the Pacific, the best wave conditions in North America can be found. Beginning in 1951, civilian pilots and scientists used retired military gliders, outfitted with instruments, to explore the wave with support from the United States Air Force and the University of California at Los Angeles. (Technically there are waves, plural, but in soaring circles it's almost always phrased in the singular: wave.)

Powered airplanes towed the gliders on long ropes, up into a frontier as perilous as it was alluring. High altitudes mean severe cold and little oxygen. Moreover, mountain waves are built around a core of violent wind called a rotor. One Project pilot had his glider destroyed around him by a rotor. He parachuted down with injuries indicating brief exposure to as much as 20 neg-

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ative and 15 positive g's.

When the glider pilots reached wave conditions and released their tow ropes to fly free, they ascended in smooth, powerful lift. (One pilot who owned a military surplus P-38 flew into the wave, feathered both propellers of the seven-ton warbird, and soared to 30,000'.) The Sierra Wave Project was a tour de force of applied meteorology. Pilots reached altitudes well over 40,000'. Joachim Kuettner demonstrated that it was possible to plan and execute a long cross-country flight in mountain wave. He went 373 straight air miles, using wave over seven successive mountain ranges eastward from Bishop, California. (5)

After 1955, studies of atmospheric wave were taken over by high-flying planes. One of these was, and still is, the U-2, the high-altitude spyplane. U-2s range up to 70,000', where the sky overhead turns midnight blue. The U-2 resembles a cross between an airliner and a sailplane. It is a fragile airplane with long, slender wings for efficient flight. It flies so efficiently that pilots have to deploy high-drag devices to get back down—just like sailplanes which, when descent is called for, open spoilers or air brakes. The glide ratio of the U-2 is 28:1, meaning it can glide 28 miles for every mile of altitude, if, for example, the engines flame out. U-2 pilots have glided as far as 250 miles to a safe "dead stick" landing. (6)

The Space Shuttle is the opposite of the U-2: massive, with short wings and a glide ratio of 4:1, slightly more aerodynamic than a rock. But glide it does. Once the problem of control is solved, you can glide far from high altitudes, even from space, even if you're not optimized to glide. And even if you didn't intend to be a glider! In 1983, an Air Canada Boeing 767 ran out of fuel at 35,000'. The pilot and copilot glided 45 miles to a safe landing on an abandoned Royal Canadian Air Force training field at Gimli, Manitoba. (7)

In general, though, aircraft that glide and soar are built for it, and have a streamlined shape with long, slim, thin wings. It took generations of aviation technology to approximate the wing of the wandering albatross. The problem was developing lightweight materials with enough strength and rigidity to prevent wings from breaking or twisting excessively under their load. At the outset, the limited structural strength of wood dictated thick stubby wings. Fabric stretched across a wooden framework was impossible to shape with great accuracy. Metal was an evolutionary improvement over wood and fabric. But the revolutionary leap came with fiberglass and subsequent composite materials. These are light, strong, and can be shaped with exacting accuracy. Fiber composite wings can be tailored to limit twisting loads, the bane of long, slender wings. Composite materials make all the difference in the world.

It's no surprise that the world's most famous experimental aircraft company is named Scaled Composites. Founded by designer Burt Rutan in 1982, Scaled Composites created Voyager, the first airplane to fly around the world nonstop with no refueling; SpaceShipOne plus mother ship White Knight; and Global Flyer, built for a successful 2005 solo flight around the world by adventurer Steve Fossett. Global Flyer has a jet engine, a lot of long, slim wing, and a glide ratio of 30:1.

The Sky is Not the Limit

The skins of modern sailplanes are so smooth that even the edges of painted stripes are sanded. State-of-the-art wings exhibit pure aerodynamic form, with winglets and other fantastic curves. Famed German Klaus Holighaus sailplane designer is said to have commented, "If it looks good, it'll fly good too."

Above all, the newest glass wings are l-o-n-g. Longer wings mean better glide ratio. The longest wings of all belong to the giant motorglider called Eta. With

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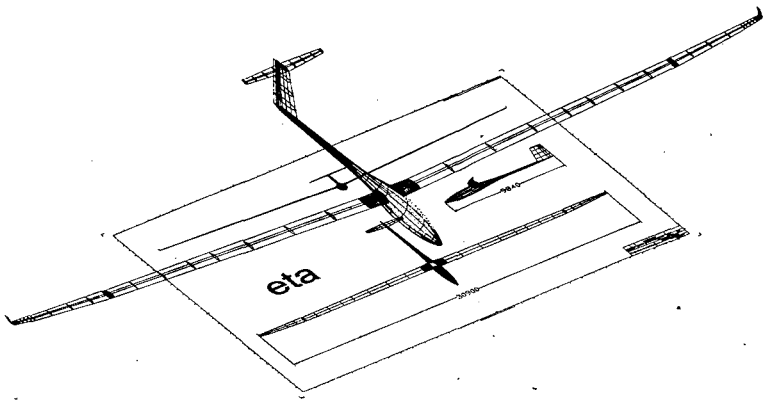

Illustration 3. The giant Eta motorglider. (Courtesy Eta Aircraft)

two one-behind-the-other seats in a slim fuselage, it has a wingspan of 101'—more than a Boeing 737. Its glide ratio is as high as 70:1. The carbonglass wings are incredibly thin for their size: the cutting edge of sailplane design. When Eta's wings are loaded, they flex, as do all loaded wings (and bridges, and bookshelves) whether the unaided eye can detect it or not. But with Eta, the amount of visible flex makes observers do a doubletake. (Illustration 3)

On the other end of today's sailplane size scale are the new ultralight sailplanes, such as the Sparrowhawk. In this size range, sailplanes can use microlift: updrafts too brief or too slight for heavier sailplanes, but possibly very common in the sky. Eta and Sparrowhawk are both answers to the perennial question of how to stay up longer in less lift. One answer is to have albatross-like wings. The other answer is to be light and nimble enough to use odd bits of lift that until now only the hawks and the vultures could feel. Either way, state-of-the-art soaring machines exist where the cutting edges of materials science, aeronautical engineering, and meteorology intersect, and we are nowhere near the limits of the technology.

As performance improves, the horizons of soaring widen in every way. Ambitious pilots make flights of 1,000 kilometers (621 miles) and more along ridge systems such as the Appalachian Mountains and the island chain of New Zealand. In hotter parts of the world, thermals are powerful and high, and sailplane pilots cover hundreds of miles by climbing as high as 20,000' in a strong thermal and then gliding to another one.

In the lee of winds blowing across the Andes Mountains, great distances can be covered by riding the mountain wave. Shortly before his Kuettner Prize distance, Klaus Ohlmann set an out-and-back record by flying 3,000 km (1863 miles) along the Andes. The straight-line world distance record as of this writing, set by Steve Fossett and Terry Delore in December of 2004 in the Andes, is 2,183 kilometers—as far as the distance from New York to Dallas.

The world altitude record in a sailplane is 49,002', set in 1986 in the Sierra Nevada wave. That record won't last much longer if the Perlan Project succeeds. "Perlan" means "pearl" in Icelandic. Rare, pearly clouds sometimes form at high altitudes and high latitudes, and Perlan, another of Steve Fossett's endeavors, is an attempt to ride mountain

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wave into the stratosphere. Meteorologists suspect that mountain wave can break through the Earth's tropopause into the stratosphere in a high-altitude, circumpolar ring of winter winds called the polar vortex. The first Perlan flights are being made with a modified production sailplane, a DG 505 motorglider in which the motor has been replaced by batteries and a liquid oxygen system. It's hoped the DG, with pilots in pressure suits, can make it up to 62,000'—U-2 country—exploring the polar vortex. The next step will be to build and design a special, pressurized sailplane to ascend to 100,000' over New Zealand or Patagonia.

On the other side of space, gliding spacecraft may explore Mars someday. With a bit of atmosphere, a lot of wing, and lower gravity, unmanned gliders are a very plausible way to explore Mars. One proposed mission involves unfolding several small instrumented gliders over Mars' huge Valles Marineris canyon to investigate the geology. Elsewhere in the solar system, several moons and worlds have atmospheres. Places where wings would work include Venus, Mars, Jupiter, Saturn, Uranus, and Neptune, plus Saturn's moon Titan and Neptune's moon Triton. Unmanned gliders are conceivable in each of these places.

And buoyancy-driven undersea gliders might work on the Jovian moon Europa. In the oceans of Earth, stubby-winged exploratory gliders dispense with hefty engines, propellers, and many hard-to-maintain moving parts. Instead, battery-powered gliders travel for days on end, making slow but steady progress, pumping seawater in and out to rise and sink down again. Similar technology might work in oceans under the ice of Europa. Instead of shifting water in and out, Europa exploration gliders might shift oil in and out of external sacks to descend and ascend. That trick changes the craft's volume and density, and it sinks or rises accordingly. The idea has the virtue of simplicity—always a good idea when sending machines across the solar system.

Sailors on a Sea of Air

Many visions of the future suggest the wings of exploration. Duncan Lunan and Gordon Dick considered flight in non-terrestrial atmospheres in a 1993 *Analog* fact article, citing aeronautics researcher Terence Nonweiler, who advocates winged vehicles for landing on an Earthlike world. Wings give you time to enquire over a landing site. Wings are an elegant alternative to using precious energy to stay aloft by other means. (8)

Far in the future, if and when colonists from Earth settle in on a new world elsewhere in the galaxy, they may have some interesting constraints on fuel choices for aviation or other transportation. Not every Earthlike world will have a trove of fossil fuel. Batteries are heavy. Solar panels mean packing delicate hardware along. Most kinds of fuel mean extra weight, at least as long as you have it, and an emergency the instant you run out.

But there's energy in an atmosphere like Earth's. Lots of energy. As the raptors know so well, if you want to fly efficiently, use the great engine that is the sky. Utilitarian and commercial aviation did not take the raptor route on Earth—fossil fuel being plentiful—but there is no reason why it could not. With the right atmospheric conditions and terrain, plus some relatively modest infrastructure, plus economic factors in its favor, gliding/soaring might be a favored way for human colonists to travel around on another Earthlike world.

This definitely includes personal transportation by means of hang-gliders. Hang-gliders use all kinds of lift, just as sailplanes do, and will excel at using microlift and dynamic lift. And among the many beauties of hang-gliders is the ease of landing. No runway is required.

Sailplanes are a more powerful exploration and transportation tool than hang-gliders, though, and more likely to form

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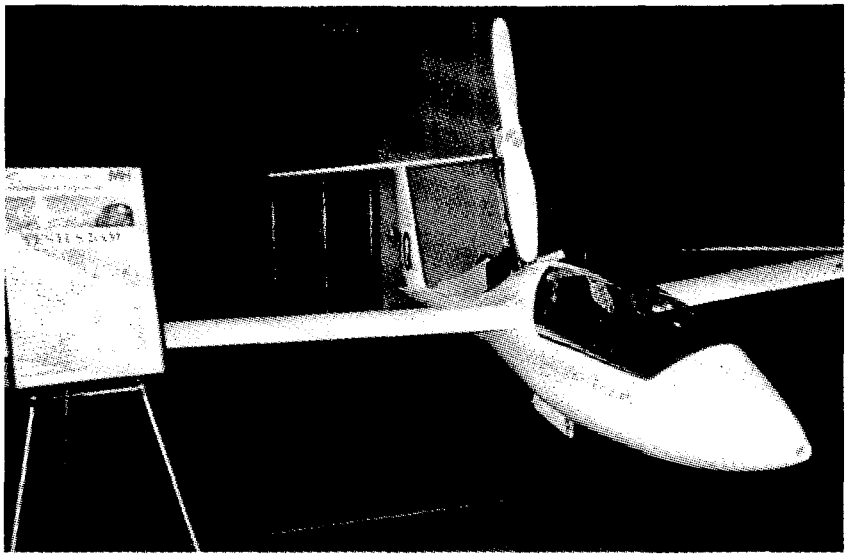

Illustration 4. Ventus 2cxM self-launching motorglider. (Photo by Alexis Glynn Latner)

a framework for aviation on a new world. Sailplanes can go much faster and higher, and carry more cargo, instruments, and passengers, better protecting everyone and everything from cold and thin air. And in strong lift conditions, strong *sink* is always a factor. Whatever goes up must come down, and that includes air, and when it goes down, it can do so with a vengeance. A sleek sailplane can hammer though strong sink where a hang-glider would be forced down—not good if the idea is to cross vast badlands in a sky shot through with lift and sink. A sailplane can withstand much more turbulence as well.

Serendipity might come into play. A far-future colony could have even more places than Earth that are perfect for hang-gliding and soaring alike. Ideal conditions would include extensive ridges and good prevailing winds; deserts with strong thermals; and large sectors of mountain wave in the lee of long mountain ranges. Given all that, you could do a lot with engineless aircraft, day and night. In ridge lift and mountain wave, night flight is eminently doable.

By the way, we need not assume tow planes to get off the ground in the first place. Self-launching motor gliders take off on their own and then turn the engine off unless they need it. Some have propellers tucked away in the nose; others have a propeller on a mast that pops out behind the cockpit. (Illustration 4) There is at least one jet sailplane making the rounds at air shows, with twin cola-can-sized jet engines mounted behind the cockpit. Eta and the sailplanes setting records in the Andes are all motorgliders. The motor stays off for the duration of a successful record attempt, but if conditions deteriorate, the motor makes the difference between reaching an Andean airport and landing in a very remote pasture.

And then there is the low tech option for getting up into the air: winches. Ground-based winches, much used in Europe and increasingly common in the United States, reliably fling sailplanes a couple of thousand feet into the air, squarely into an area of ridge lift or a predictable thermal source. Every locality has its stepping-stones into the sky, places where the ridge or the "house

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thermal" works much of the time. The locals know just where these spots are.

Only a century into mechanized flying on Earth, locals are invariably a smart bunch. Club and competition soaring pilots know how to go cross-country. They understand the way the atmosphere in their part of the world works. The most challenging soaring of all is in the mountains—not just in the wave *over* the mountains, but the valleys and chasms *between* peaks and precipices. Such regions have complex patterns of wind, sink and lift, and, in particular, tricky downdrafts that can smash a sailplane against a cliff. Yet local pilots are scouting out reliable aerial pathways through great ranges like the Alps, the Southern Alps of New Zealand, and the Rockies. Colorado pilots can climb into the sky above the Continental Divide.

What if humans explored and soared a new world for generations, a whole world where it made practical and economic sense to soar? In other words, what if a whole human culture *really* knew how to fly? Modern societies have plenty of airplanes, but few people who understand the air. Even the airline pilots complain about how autopilots and fly-by-wire controls distance the pilot from the sky. Our whole society has a deeply ingrained sense that to go from point A to point B to point C means motoring in a straight line, typically on an interstate freeway.

Travel hasn't always been that way everywhere. The Polynesians, for one example, understood the currents and the winds of the Pacific Ocean well enough to journey thousands of miles to far-flung islands in rafts. Perhaps someday human colonists might have the time and incentive to understand a new world's atmosphere that well: to grow as intimately familiar with their skies as the Polynesians were with the currents of their seas.

In another scenario, the new world would be Earth, older, hotter perhaps, and post one or more cataclysms, with civilization crashed and rebuilt, with no more oil reserves and a sea-changed global economy. A new, old Earth where long-winged gliders climb the sky, brightly-colored hang-gliders cluster in warm regions like butterflies in the sunny spots of a garden, and flocks of ultralight motorgliders crisscross the seas using a cup of fuel and a mastery of dynamic lift, like their fellow travelers, the albatrosses.

Always Another Adventure

The Morning Glory forms on a seabreeze front in the Gulf of Carpathia in southern Australia. It's an otherworldly-looking, white roll cloud that stretches from horizon to horizon and moves inland. Soaring flights of three hours and flights of almost two hundred miles have been made on the Morning Glory to date. Earth's atmosphere is full of surprises. And everywhere there is a surprising lift in the air, inquisitive sailplane pilots show up to investigate.

Depending on your point of view, even the local summer thunderstorm is an otherworldly marvel. Cumulonimbus clouds produce powerful updrafts, accounting for some early soaring altitude records (and fatalities). Sailplanes racing in contests sometimes dart under the edges of these storms, venturing into the meshing gears of the atmospheric energy engine in hopes of gaining the advantage to win the race.

Earth's atmosphere is still a strange new world. It may not look that way from the seat of a jetliner streaking through clear air over, say, the rolling hills of Ohio. But there be dragons: the cumulonimbus clouds. And monsters: mountain waves towering over their rotors. And wonders like the Morning Glory.

As a thought experiment, we can well imagine future wings on the intricate winds of new worlds. Remember that almost anything with wings can glide a long way in an emergency, given enough altitude to start with. But long, slim, thin wings are the most efficient.

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In imagination, we can duplicate some conditions on Earth and extrapolate others. Tweak the parameters of planetary evolution, atmospheric density, and geography: maybe no fossil fuel, but vast hot badlands, long mountain ranges, and an atmosphere with favorable dynamics. It would be especially interesting to posit an otherwise Earthlike world with days and nights longer than Earth's, with more solar heating to generate thermals, and possibly a steeper differential between onshore and offshore temperatures, creating more powerful and perennial coastal winds.

So we can imagine a world where gliders and hang-gliders routinely traverse long ridge lines and coastlines' lengths of sea cliffs. Gliders thread through jagged mountain ranges day and night with only the occasional, much-remarked-upon mishap. Heavier, well-insulated sailplanes routinely launch into atmospheric waves to go high and far. All because people know how to control flight and understand the atmosphere intimately well.

In a different scenario, humans new to a world might ask the intelligent, long-winged natives about the ways of their sky. . . . But that's yet another story.

Endnotes

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(8) Lunan, Duncan and Gordon Dick, "Flight in Non-Terrestrial Atmospheres, " *Analog*, January 1993.

Websites of Interest

Eta's home page is http://www.leichtwerk.de/eta/

Morning Glory Cloud page at http://www.dropbears.com/brough/

Perlan Project page is http://www.perlanproject.com/Perlan/

Pterosaur Page by the University of California at Berkeley Museum of Paleontology www.ucmp.berkeley.edu/diapsids/pterosauria.html

Soaring Society of America Website is www.ssa.org

SpaceShipOne home page at http://www.scaled.com/projects/tierone/

For grist for the mill of imagination about soaring on other worlds, visit soaring sites on Earth.

Ridge Soaring Gliderport in Julian, Pennsylvania launches sailplanes into ridge lift much of the year. (http://www.sac.ca/cas/hangarflying/ridgeprimer/gillespie1.html)

Soar Minden in Nevada regularly takes visitors up to 30,000' on mountain wave capped by lenticular clouds (www.soarminden. com).

Teton Aviation in Driggs, Idaho, offers scenic glider rides up and over the Teton Mountains. (http://www. tetonaviation.com/soarindex.html.)

Particularly intriguing is Marfa, in West Texas, 30 miles south of the Davis Mountains and McDonald Observatory. Marfa's soaring operation acquaints visitors with thermals up to 18,000'. The area has mountain wave in the early spring, the bones of the pterosaur Quetzelcoatlus in the ground, and some of the continent's best conditions for seeing stars in the night sky. (http://www.flygliders.com/marfa.htm) ■

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CHARLES L. HARNESS 1915-2005

Charles L. Harness, well known for a unique kind of science fiction in *Analog* and elsewhere, died on September 20, 2005, after a long illness. Born December 29, 1915, in Colorado City, Texas, he attended Texas Christian University in Fort Worth and George Washington University in Washington, D.C., earning B.S. and LL.B. degrees from the latter. He worked awhile as a mineral economist for the United States Bureau of Mines, and was for many years a patent attorney for the American Cyanamid Company and later W. R. Grace and Company in New York and Washington.

His intimate familiarity with the practice and oddities of patent law often made important contributions to his stories, which included half a dozen novels and many shorter pieces, but there was far more to them than that. He had an imagination not quite like anybody else's, often combining the rigors of both natural and human law with fantasy and mythological elements in intricate plots peopled by memorable characters. There weren't as many of them as his readers might have hoped for, but he produced more than his share of memorable stories in his six-decade career, which began with a cover story for *Astounding* in 1948 and will continue into the future with several new posthumous publications. Both he, a thoroughly professional craftsman and artist, and his work will be deeply missed.

He is survived by a brother, a daughter, a son, and their families, to all of whom we extend our sincerest condolences. Memorial donations may be made to the Kidron Bethel Retirement Village in North Newton, Kansas.

—Stanley Schmidt

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Nothing to Fear But

Stephen L. Burns

Most blessings are mixed—but how about curses?

Dear Stan,

As a long-time reader of *Analog*, I know that more than a few members of your readership take the plunge and try to write a story that might just make it to the magazine's pages. If you have any way of accessing subscription records you'll see that I have twenty years (and probably an extra twenty pounds) under my belt.

But this isn't a story. Well, it tells a story of sorts. It might be delusion, but it isn't fiction.

Let me explain: I'm the chief Fire Investigator for a certain county in southwestern Pennsylvania. Not bad for a girl who got A's in all her science classes, and read as much SF as she could get her hands on as a teenager. I've held this position for about five years now. Most fire investigations are pretty cut and dried. But now and then one comes along that leaves you with more questions than answers. Or worse yet, ***haunts*** you.

I'm sure you have met a large number of techies, so maybe you've heard of Jeffery Bloss. Bloss Devices was not a large company, and it served a very specific niche: the design and creation of all sorts of sensing devices. Medical equipment, airport bomb sniffers, earthquake warning devices; all those and many more tools and instruments depend on components developed by Jeffery Bloss.

Here in my county he was something of a curiosity. Most people were aware that he was some sort of egghead scientist or inventor, but what they mostly knew was that he was very rich, extremely reclusive, and maybe crazy. When he was young he was known as Phobia Boy, and the name stuck. It was widely known that he still lived and worked in the house where he grew up—much added to by this time—and had not stepped outside it since he was a small child.

Maybe you read somewhere that his house burned down early this summer. He was found inside, and his death ruled a suicide. The fire was arson. He set it himself.

The house and contents were a total loss, but one outbuilding survived, and in it I found a backup network server.

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On that server's hard drive I found, among other things, the materials I distilled for what I've enclosed.

Having read *Analog* as long as I have, I'm willing to bet you have a pretty decent feel for what's possible, and what's pure moonbeams. What I've sent are bits and pieces from files I found on that computer, covering almost a year's time. At the end of all that is one more page from me, with a couple questions I hope you can answer.

Enough from me. I'll let Jeffery Bloss speak for himself.

9.13.04:2118 Bad day.

Could barely make myself even cope with the presence of Kamalsky and Jones, and I've worked with them for long enough to even be able to deal with them in person. Was supposed to meet with Singh from Safe-T-Systems. Threw up twice before the appointment, could only make it as far as the doorway to the conference room, made a fool of myself for the five minutes I was near him, got sick again afterward. That time mostly from shame and frustration. No reason to be afraid of him, just stupid phobias.

I hate this. Hate being me. Hate being afraid of everyone and everything. Would blow my own brains out if I weren't afraid of guns, afraid of death, afraid I'd botch that, too.

9.16.04:0321 Can't sleep again.

Lonesome. Afraid. Always afraid.

For the millionth time I wonder: what is fear?

It's an emotion. A chemical reaction. A response to stimuli. Except when it isn't, like with me, the panphobic.

Drugs don't work. They might blunt my phobias a bit, but they blunt me even more in the process. Make it hard to think, hard to concentrate. Work is all I have.

9.16.04:0359 Other thoughts:

Fear is chemical, hormonal, and all of that. But, the brain being what it is, isn't it also electrical? Synapses firing in a certain pattern? And with phobias or other long-standing fears, might these not be recurrent patterns?

If that is true, then shouldn't there be a way to interfere with that pattern? To nullify it?

10.9.04:1234 Convinced there is a pattern.

Just can't seem to find the damn thing. Tried various methods, even bought my own personal MRI. Lovely machine, but no help. The same with other existing equipment. Have to design my own sensors. Good thing that's the one thing I can do with any confidence.

10.11.04:1927 The hunt does not go well.

What I'm looking for is subtle and elusive. Even in a head like mine it's a dull glowworm gleam, not a flashing neon sign. Need an entirely different kind of sensor. Very sensitive to the slightest change-state, like those enormous underground setups for detecting neutrinos.

10.23.04:2216 Barely able to work today.

Bumped the TV remote by accident, saw just a minute of news, enough to fill me with a day's worth of terrors. Endured a meeting with Gravely, liaison from DOD, about munitions/bomb sniffers capable of fitting inside a small drone airplane that could be flown ahead of a convoy to check for IED's. Got back to the parts of the house where I feel safest, got frantic when I heard a sound I couldn't identify. Became convinced a mouse or snake or insect had gotten in. Could only deal with it the way I usually do: put on breather hood and flooded rooms with CO_2.

Profound fear of suffocation from the hood, but less crippling than fear of creepy things. If there was something,

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it's dead now.

Probably was nothing in the first place. Pathetic.

11.6.04:2324 May be on to something.

Have come up with idea for a new kind of sensor. Fairly small, exquisitely sensitive, bicameral; meaning it will work paired with an identical sensor opposing it—or more properly, the other half of itself. Several pairs could make an array. Have begun hand-fabricating the first pair, with help from Kamalsky and Jones.

11.12.04:0931 Progress.

Have K & J making more pairs while I figure out how to integrate output into a sort of holographic representation of what is being sensed. Feeling some optimism. May be on the way to building a lens for finding fear.

11.19.04:1543 My utter stupidity continues to astound me.

Too involved? Maybe. Putting in even longer hours than usual, getting by on less than 3 hours sleep—mostly from short naps—each 24-hour period.

Could not immediately use the sensor array to find what I seek, of course. Want to find something? First establish a baseline where the thing you seek is either not present, or is at least at an acceptable background level.

Kamalsky and Jones both let me take readings from them. Kamalsky skydives, goes whitewater rafting, and she keeps snakes for pets. Jones is an ex-Marine and black belt, has been a volunteer fireman, plays sports. Kamalsky doesn't seem to be afraid of anything. Jones is creeped out by her snakes, so using one of them to look for a fear response was fairly easy. For them. Just the thought of a snake being here in the building had me locked in the bathroom throwing up from the time it came until the time it left.

11.25.04:2154 All alone today, everyone off for Thanksgiving.

No matter, plenty to do, and I am my own turkey. Now have collected multiple exemplars of normal and fear-response readings taken from other employees and some friends of K & J. Worth the bonuses I paid.

At one end of the spectrum, normality. At the other, me.

Can't go out of course, but from one of my windows I can (when I'm feeling brave) peek out and see my nearest neighbor's yard. Every Thanksgiving he puts up lights for Christmas, and he did it again today. He wraps strings of bulbs around the small trees in his front yard. At night they turn into something almost magical, these three-dimensional constructs of light hanging in the air, sometimes seemingly unsupported, other times appearing to stand on a single twisting leg of light.

Fear is red. My sensors detect all sorts of mental activity, and the trick was in isolating the one I was looking for. The colors applied to this mapping are false, of course. In the model we've devised, all normal and other activity is pink to white—strong to weak.

I have seen my fear; it's on a computer screen before me right now. It's a twisted, tangled, million-pointed, complex thing hanging there like those lit up trees, rooted deeply in my mind and burning red every day of every season.

I have seen the shape of my life-long enemy.

12.12.04:0521 I am afraid.

How strange. I have found a new fear. I am afraid of one of the few things I never feared before: failure.

The list of things I am afraid of/phobic about is, well, terrifyingly long, even when broken into broad categories: open spaces and closed spaces; heights and being underground; fire, water, sunlight and moonlight, most weather; most animals and all reptiles and insects; most diseases and ailments and condi-

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tions and afflictions; certain foods; most people and all social situations, especially people in uniform or costume, which includes police, nurses, nuns, delivery men and clowns; being in the same room with other people, and being alone.

Yes, that last one too. Only I seem to have a better handle on that one than most of the others. I can stand it, mostly, except for those times I can't.

But never have I doubted my own intellect, talent, creativity. I sometimes think of myself as a natural-born problem solver. Just as the juices in my gut can break down the donut I'm presently eating, my mind does the same thing with problems. They are subsumed and attacked from every direction, broken down into component pieces, digested. In place of the doughy knot I began with, I have a sheaf of answers for its reconstitution as something useable.

But not this time. Not yet. I can see the fear, but can't figure out how to defeat it.

I don't want this to be the one that stumps me.

1.5.05:2154 New year, new idea!

A way to suppress specific areas of electrical activity with, I hope, finer than pinpoint accuracy. Many possible other applications, but only one counts right now. Only one gives me hope.

5.1.05:1209 Feeling fooled.

Wouldn't it be today, April Fool's Day, that the last three months of work have come to nothing. K & J are off grabbing some lunch.

Me, I have to go throw up again.

5.1.05:2141 The joke was on me.

It was Jones who gave us our breakthrough. The goal of the antanxiety field we are trying to generate is to suppress the fear pattern. I had been thinking in terms of trying to douse a fire with a hose, and expressed that analogy. Jones is a fireman, and pointed out that we would only be hitting the front face of the fire. As with real fires, maybe we should be hitting it from two directions. Surrounding it and snuffing it out.

So we set up a second field inducer about two feet from the first with the test subject in between.

Still no effect on the guinea pig—me. The sensors showed no drop in my usual fear quotient.

But by then I had begun thinking about the approach Jones had suggested. I believe two opposed inducers will create an oval field, shape, and strength yet to be determined. What about placement? Front to back, or sideways, hemisphere to hemisphere? Would we need four? Are there any phase effects as the two fields interact?

I sent them home hours ago. I'm really tired myself, but can't sleep. Too many things to figure out, too much work to do.

I think we may be close to driving the monster out of my head.

5.20.05:1615 Phasing turned out to be critical.

We actually use the interference patterns. The programming of the app that reads the fear response and then provides targeting information has been a bitch, but the kludgy version is showing promise.

First real test today, and I was actually able to hold a mouse in my hand (!!). Unfortunately the targeting is a bit off, and I was not able to speak coherently while the field was on. Tweak code and settings. The next time I was again able to hold the mouse (so soft and delicate, almost like a warm, furry, soap bubble; strange that something so harmless could provoke such terror in me), but went color-blind and was nearly knocked flat by the smell of roses.

K & J got worried about that one, wanted to halt testing, but the guinea pig overruled them.

5.23.05:2153 Homing in on it!

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Held a lit match, put a paper bag over my head, ate an avocado, all with no ill effects. Held a rabbit—another indescribably amazing experience—and was able to stand while doing so with only a very slight dizziness. Have decided against testing with one of Kamalsky's snakes (much to Jones's relief), but I have consented to try a dog. A *big* dog. Watched the news with the field energized. Did not need to stop watching, or throw up.

Have already begun work on a portable version.

5.24.05:1132 The dog was a wonder.

Big and funny and friendly—and it turns out I'm allergic! At first I thought the sneezing and itching were side effects of the field, but no. Almost too funny. Too bad. I really liked that dog. His name was Ralph. He licked my face!

5.26.05:0217 Questions.

What will I do when the portable unit is ready for use?

Go outside. Look at the sky. Smell the air. Walk the street. Smile at anyone I meet. Maybe buy something in person, from a stand or store, just like anyone else. Doesn't matter what.

I hope I see a pretty girl.

I've always wanted to smile at a pretty girl, and wondered what it would be like to have her smile back at me.

Spending as much time inside the lab rig as I can, which limits me to one room. I can watch the news, watch movies I wouldn't have dared watch before. Make calls. Play with the mouse, who likes to sleep in my shirt pocket.

It looks like the portable unit will be more cumbersome than I hoped, but I'm in a hurry to get it finished. Refinement can—and will—come later. Already started designing the next generation, and my ultimate objective is to make the antanxiety field generator implantable.

There are millions of people like me. People whose lives have been ruined by fears and phobias. We can all be set free from our demons, from the monster squatting inside our heads. We can finally be like other people, lead something like normal lives.

In selfishly doing something for myself, I may be on the yerge of doing a truly great thing for others.

5.26.05:0407 Can't sleep for thinking about it.

Imagine, an end to fear! Not just for those of us for whom it's pathological, but for everyone! The battered woman no longer afraid to leave her abuser, or to stand up in court against him. No fear of the dentist. No fear of heights, or failure. No fear to raise your voice, to hold to your convictions. Fear is the weapon used by so many tyrants for so long.

Fear of the dark, of the other, of the unknown. A thousand bitter flavors of fear blunted or wiped away.

6.06.05:1543 The first field test was a success and a failure.

Worthy of tears, and now that I'm recovered, laughter.

I walked out my own front door. Actually it was the overhead door in the garage, that being wide enough to let Jones and Kamalsky stay at some distance on either side of me. Back straight, head high. The power pack and control equipment and other assorted stuff are built into a rather large leather camera bag I can wear hanging off my shoulder without looking too odd. The inducers and the sensors to guide the field are inside a hat, a thin wire running from it to the camera bag.

I've lived in the same house my whole life, and by the time I was four, I had to be heavily sedated to be taken from it for visits to doctors. So I was seeing my own front yard in person for the first time in a bit over 27 years. I actually looked back at my house from the outside.

I felt no fear, even though it's been years since I've even strayed down to

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the first floor of the house. Not from being away from my safe upstairs rooms. Not from the hot sun burning in an overlarge blue sky, or the birds that flew in that sky, or the cars driving by on the street, or the bugs that buzzed around me. I saw a *bee* and didn't get hysterical.

I felt the sun on my face. I felt the wind.

It was the wind that got me. A gust came out of nowhere, and one moment I was starting to laugh from the sheer joy of my release, the next my hat went flying off my head.

The whole situation went to hell in an instant. My sense of safety and security and fearlessness shattered, collapsed, imploded, and exploded all at once, taking me out and down in the process. I hit the ground in shrieking hysteria. Kamalsky tried to grab me, but in spite of the time I've known her, and how much I trust her, at that moment having someone try to touch me just made things worse. Meanwhile Jones was sprinting after my errant hat. I saw that much before I fainted.

When I came to I was in my own rooms, and they had put me back inside the lab antanxiety unit, backed off, and turned it on.

I feel better now.

Needless to say, a redesign is in order.

6.08.05:1539 Plan B.

I was perfectly willing to have the inducers glued—or for that matter *nailed*—to my head, but J & K overruled me. Now the inducers and sensors are securely attached to the inside of a tight-fitting stretchy fabric cap Jones assures me is quite stylish. Not sure it's me, though. So I decided to wear a baseball cap over that. The wire between the hat and camera bag unit has been reinforced because it broke last time. That was part of the delay. The inducers have to be painstakingly tuned to each other. Hat Model 1 blew into the street before Jones could grab it, and it got run over by a car. That crushed one of the two inducers.

This new getup works quite well. I returned to my front yard this afternoon, even walked out on the sidewalk a bit. I was outside for over an hour, testing my limits and being watched like a hawk by Kamalsky and Jones.

One thing they are watching for are aberrations in my judgment brought on by the fear suppression field; things like impulses to go play chicken with traffic, leap off tall objects, eat the lawn.

They said I acted quite normally, considering.

6.09.05:1753 More field—or at least yard—testing.

Part of that was checking to see if any other devices interfere with the field, or vice versa. So far, unaffected by—and having no effect on—computers, cell phones, pacemakers, etc. Outside a whole two hours. No phobias, no deciding I'm Superman.

But the thrill is gone. I'm eager to go further, explore more. Effect of the field, or just-released prisoner syndrome?

Maybe both. Have gone back and forth about it with Kamalsky and Jones and reached no real conclusion. They are pressing for caution. Me, I'm almost giddy with eagerness to go up, up, and away.

6.10.05:1834 More time in the yard.

One hurdle cleared. I met the mailman out front as he was making his delivery. He had undoubtedly heard about me and my peculiarities, if not my condition. I realize everyone around here must have. He seemed very surprised to see me out and about. Once meeting a stranger like that would have thrown me into a crippling panic. Instead I smiled and introduced myself, explained that we were working on a new method of treating the phobias that had kept me locked away. Took the mail from him, not even a quiver as his fingers touched mine, something that would have had me puking until I fainted.

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Other main reason this was a sort of watershed moment: the antanxiety field seemed to have no observable effect on him.

That's been another unresolved issue. We know that the inducers generate a field in the shape of an elongated oval, but we don't know how far it reaches, how strength varies by distance.

Nor do we really know what happens when another person strays into the field. So far we've made sure that K & J stay at some distance from the narrow side of the field, so if there is any degradation of rational fear they won't be affected, and their watch over me compromised. I don't think it's really an issue. The field is too small, too weak, and what is being generated is keyed only to me.

Matters to be dealt with later. The more I am under the field, the more my confidence grows. Is it possible that over time the field effect could be detuned, letting fear creep back, and allowing my growing desensitization and self-assurance deal with it? Wouldn't that be something!

6.11.05:1705 I want to leave my yard, dammit!

Now I'm the one with less fear than them, and I'm really beginning to chafe under their caution. I can see the reason for it, and understand it intellectually, but I've been cooped up my whole life, and now I'm out . . . only to be chained up in my yard like a bad dog that might chase cars.

6.11.05:1843 Fear and helplessness.

There is my whole life summed up in two words.

Now I can finally stand outside the prison they made for me, see how I lived, and wonder how I ever stood it.

Fear was the enemy, and I defeated it. Or will have defeated it when I can at last do the normal, ordinary things so long denied me. When I change myself. And then I can change the world.

6.11.05:2120 I can't stand it any longer.

I'm going out. Why shouldn't I? What am I waiting for? I could call Jones or Kamalsky back to act as escort, but I'm willing to take the risk of flying solo.

Risk. What a delicious word. I can take a risk, can even act spontaneously. What a change from the days where I had to psych myself up for at least a week before I could cope with a meeting with another human being.

Still, I must be prudent. Not overreach. I won't go far, just to the grocery store over on the next block. Maybe I'll even buy something! Must take some money.

While hardly a voyage around the world, doing something as normal as going to the store would not so long ago have been as impossible and unlikely as my being shot into space to play golf on the Moon.

6.11.05:2251 Home again.

Kamalsky and Jones—

No, Julia and Ahmed. My fear of intimacy always forced me to only use your last names. But I know who you are, and I treasure you. I want you to know that.

Here's what I have to tell you: You were right, and I was wrong. More wrong than I could have ever imagined.

I went out this evening. Just a quick trip to the store. It was a beautiful evening to be out. The air was fresh and sweet, the sun was settling toward sunset. Flowers and birds. Other people out and about, enjoying the evening.

And I was able to walk among them. Calmly, even taking pleasure in it. It was one of the happiest moments of my life.

I went to the store with the anticipation someone else might feel approaching some great attraction like the Taj Mahal or the Louvre. You must remember I've never been in a store before.

When you're phobic you're always imagining the worst that could happen. I've had a lifetime of such imaginings,

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but not a one of them could compare to what did happen.

I went inside the store. I bought a packaged cake, figuring I could celebrate with it when I got home. I went into the checkout aisle.

The woman at the register smiled at me as I approached with my purchase. It was a tired smile, and under it lurked something I was too obtuse and unsocialized to recognize, though I should have: fear and wariness.

The police sorted things out afterward, and took my statement. In the course of all that, I was able to reconstruct what happened and understand my part in it. The police only saw me as a witness. They didn't know—couldn't know—that I was the one who killed that woman who smiled at me, just as surely as if I'd shot her myself.

You were right, and I was wrong.

The antanxiety field can affect others who come within its range, and that range is longer than I could have ever guessed.

One end reached the woman who had smiled at me. It made her smile softer as all her fears were erased.

The other end wiped away the fears of her ex-husband, who had been stalking her for some time, and who was lurking in the next aisle.

All constraints on his behavior vanished, his fear of reprisal or getting arrested swept from his head. He laughed, and pulled out the pistol he was carrying and pointed it at her. She stared back fearlessly and laughed at him. He screamed that he was going to kill her. She laughed again and stuck her tongue out at him.

I stood dumbly in the middle, confused by what was happening. But not afraid.

He fired one shot that missed. She started to climb over the checkout counter to go after him.

I had started to turn at that first shot, which changed the focus of the field. Both of them were still in it, but now it reached others. One angry-looking man who had been waiting in the next aisle suddenly tucked the beer he'd been waiting to buy into the crook of his elbow, shoved the person ahead of him out of the way, and sprinted for the exit. Another checkout woman, who was being harangued by a customer who was angry that she wouldn't accept outdated coupons, suddenly slapped the customer across the face.

By then I was turning back, and my checkout woman was up on the counter, yelling at her ex-husband, screaming that she wasn't afraid of him any more.

That's when I finally understood what was happening. I was the cause of all this. I snatched off my baseball cap and tried to get my fingers under the inner cap that held the inducers.

The second shot came just as I got it off.

I collapsed, shrieking as a thousand old terrors came flooding back, new and all too real ones riding the wave. The checkout lady who had smiled at me fell on top of me, smile gone, blood gushing from the ragged hole in her forehead.

After a timeless interval, maybe a minute or so, I managed to get the cap back on again and regained control of myself.

But it was too late. The woman was dead. Her husband, probably panicking when the field's influence ended, fired several other shots, wounding two people, then ran out of the store. As luck (of one kind or another) would have it, the police who had been called just before I got there because the woman's ex-husband had been violating a restraining order, arrived. The gun was pointed at the police and one shot fired. That shot blew out one window of the police car. The fire they returned was more accurate. The man was dead before he hit the ground.

So there you have it: my trip to the store set off a miniature apocalypse.

With careful management of the

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field's effects I was able to give a brief statement and then get the hell out of there.

One side of my mind insists that I can make changes to the antanxiety field, make it safer to use.

But I know better. All I have to do is imagine what might happen if the field as it now exists were to be used by governments, the military, police, criminals, or terrorists.

My life made me see fear only as a limitation, an oppression. But it is also a check on our behavior. Without it we would be little better than animals.

So, Julia and Ahmed, take warning from my report. I've sent you each a glowing recommendation and a two million dollar bonus. Retire, go into some other field, but whatever you do, *do not* try to replicate the work we have done. Let these words and what has happened make it clear: *what we have to also fear is a lack of fear.* Think on that and be afraid. Be very afraid.

Good luck.

Jeffery.

—Oh yes, I did some checking up on the postman. He's a Zen Buddhist monk when not delivering junk mail. Bad test protocols always come back to bite you.

6.11.05:2344 The drugs are starting to kick in.

Feeling logy and sleepy. Messages sent, work at an end. When my heart stops beating, that will trigger the incendiary devices I've built and placed all over the house. Everything must go, all records, everything we built.

Funny, I was always afraid of fire.

Not now.

Nothing to fear.

Noth

The house burned to the ground, a total loss. But he overlooked one detail. As I mentioned at the beginning, he had a backup network server in a safe place outside the house.

Ahmed Jones and Julia Kamalsky would not tell me what Bloss was working on when he died. I was barely able to catch up with them for an interview. One was relocating to Hawaii, the other to Alaska.

The violent events Bloss described did transpire on the night he died, pretty much as he described them. The police report listed him as a witness.

Other than the excerpts I have sent you, all copies of all files have been destroyed. I know fires, and believe me, mine didn't leave a trace of any paper or disks, and reduced the server to a puddle of melted metal.

So one question that has plagued me enough to make me send you the preceding materials is this: could he have really done it, built a device that erases fear?

I hope you might have an answer to that.

As for my other question, I really won't mind if you prefer not to provide any sort of answer or opinion. But I'll ask it anyway:

Is Bloss right? Are we doomed to live with fear forever?

I know that now I'm afraid the answer is *yes.* ■

MOVING?

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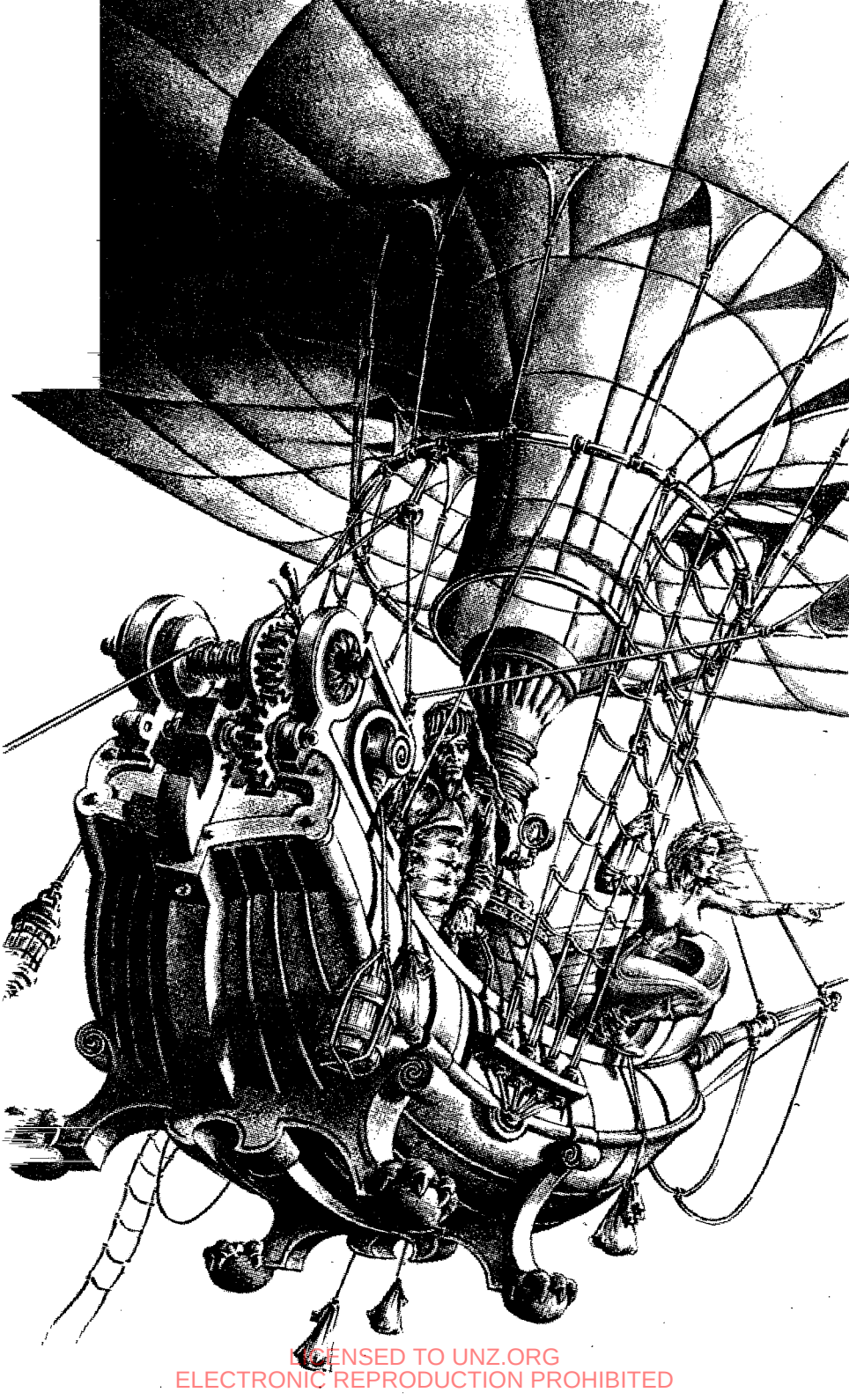

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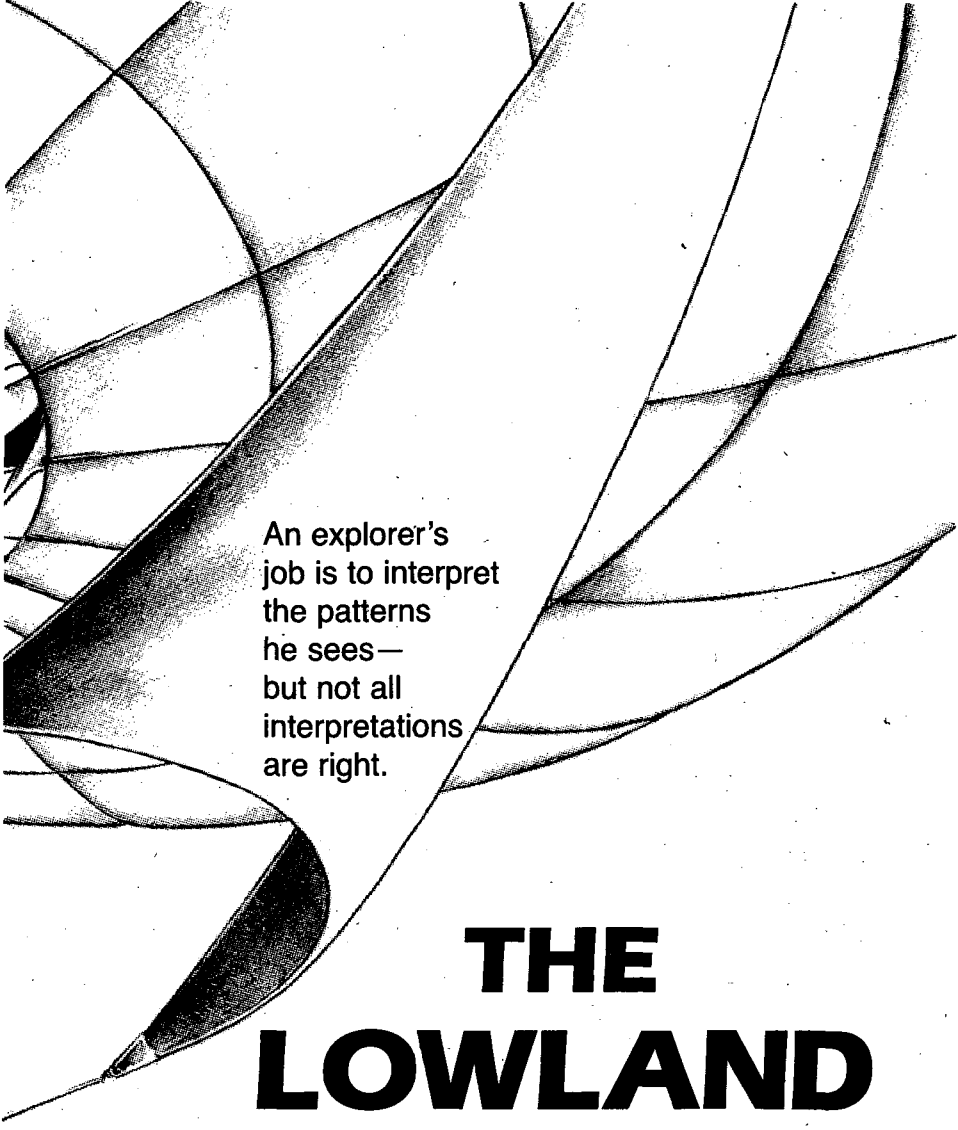

An explorer's job is to interpret the patterns he sees— but not all interpretations are right.

THE LOWLAND EXPEDITION

A Tale of Old Earth

Stephen Baxter

Illustration by John Allemand

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(Note: this story is set a few centuries after the events of "The Time Pit," *Analog*, October 2005)

Enna relished her flights in the spotting balloon.

She loved to see the Expedition train strung out across the Lowland's arid plain, with its spindling-drawn wagons, the chains of servants and bearers, the gleaming coach that transported her father and his precious books, even the small flock of runner-birds. If the weather was fine the Philosophers themselves would walk, marching into the Lowland's mysteries, arguing endlessly. The Lowland Expedition was a grand gesture of the civilization of the Shelf that had spawned it—and it was brave too, for all the explorers knew that they could never go home again, whatever they discovered.

Down there was Tomm, one of the junior cartographers. Whenever Enna flew Tomm always wore a special red cap so she could pick him out, a bright red dot in the dusty line of Philosophers. At twenty-one he was just a year older than Enna herself—and he was her lover, though that was a secret to all but her closest friends, and certainly to her father, or so she hoped. When he saw her, he waved. But his waving was sluggish, like an old man's.

On Old Earth time was layered. When she rode her balloon up into the air, she was ascending into quicker time. If Tomm's ears had been sensitive enough he would have heard her heart fluttering like a bird's, and conversely when she looked down at him he was slowed, trapped in glutinous, redshifted time.

The balloon flights were invaluable aids to navigation, but Bayle, Enna's father, had strictly ordered that flights should be short, and that his party should take it in turn to man them, so that no one fell too far out of synchronization with the rest. "This trip is challenging enough for us all," he insisted, "without the wheels of time slipping too." Enna accepted this wisdom. Even now, despite the joy of the flight, she longed to break through the barriers of streamed time that separated her from her love.

But when she spied the city on the horizon she forgot even Tomm.

The light of the Lowland was strange, shifting. Storms of light swept across its surface, silent and flaring white. These founts of brightness were in fact the major source of light on Old Earth, but they made the seeing uncertain. Enna was unsure at first that the bright white line she spied on the horizon was anything but weather: a low cloud, a dust devil, even a minor light storm.

But in a rare instant of clear seeing, it resolved into a cluster of geometrical shapes, unmistakably artificial. It must be a city, stranded in the middle of the Lowland, where nobody had expected to find any signs of humanity but the meanest degradation. And Enna had discovered it.

She turned immediately to the pilot. "Do you see it? There, the city, can you see? Oh, take us down! Take us down!"

The expedition's chief pilot was a bluff, good-humored fellow called Momo. A long-time, military-service companion of her father, he was one of the few people to whom Bayle would entrust his daughter's life. As he had lost one eye in the wars, he "couldn't see a blessed thing," he told her. But he believed her, and began to tug on the ropes that controlled the hot-air balloon's burner.

Enna leaned over the descending gondola, yelling out news of her discovery. As the time differentials melted away, faces turned slowly up towards her.

The Philosophers entered the city in wonder. Enna walked hand in hand with Tomm.

The city was a jumble of cubes and rhomboids, pyramids and tetrahedrons—even one handsome dodecahedron. The walls were gleaming white

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surfaces, smooth to the touch, neither hot nor cold, and pierced by sharp-edged doorways and windows. The buildings towered over the explorers, immense blocks of a geometric perfection that would have shamed even the grand civic centre of New Foro, Enna thought.

There were no doors, though, and the windows weren't glazed. And there were plenty of other peculiarities. Without inner partitions, each building was like "one big room," as Tomm put it. Between the buildings the ground was just dirt, not paved or cobbled as were the streets of New Foro, back on the Shelf.

"And there's nobody here," Enna whispered. "Not a soul! It's so strange."

"But wonderful," Tomm said. He was tall, strong but sparsely built, with a languid grace that disturbed her dreams. "This must be a terribly ancient place. Look at the finish of these walls—what is this stuff, stone, ceramic, glass? Far beyond anything we are capable of. Perhaps the builders were Weapon-makers."

"Maybe, but don't you think it's all rather eerie? And it's such a jumble—"

"A cartographer's nightmare," Tomm laughed.

"And why are there no windows or doors?"

"We can make windows," he said. "We can hang doors." He took her hands. "Questions, questions, Enna! You're worse than all these grumpy old Philosophers. This is your discovery. Relish the moment!"

There was a deep *harrumph*. Bayle, Enna's father, came walking towards them, trailed by acolytes, lesser men but Philosophers themselves. "But she's right," Bayle said. "There is familiarity, and yet perhaps that blinds us to how much is strange. . . ."

Tomm hastily released Enna's hands.

Bayle wore his dress uniform, topped off by his cap of spindling fur and feathers. Though he had devoted the last three decades of his life to science, Bayle had retained an honorary rank in the army of New Foro, and "for the sake of general morale," as he put it, he donned his uniform to mark moments of particular significance during their long journey. But Enna knew that no matter how extravagant his appearance, her father's mind was sharper than any around him.

He tapped the walls of the nearest building with his stick. "Certainly the layout follows no obvious rational design, as does the centre of New Foro, say. But there are patterns here." He walked them briskly through the narrow alleys between the buildings. "Can you see how the largest buildings are clustered on the outside, and the smaller huts are trapped in their shade?"

"It almost looks organic," Enna said impulsively. "Like a forest, dominated by its tallest trees."

Bayle eyed her appreciatively. "*I* was going to compare it to a bank of salt crystals." Salt had become something of an obsession of Bayle's during their journey. There was salt everywhere in the Lowlands; there were even plains covered with the stuff, the relics of dried-up lakes. Bayle was gathering evidence for his contention that the Lowland had once been the bed of a mighty body of water. "But I admit, daughter, that your analogy may be more apt. This city is not planned as we think of it. It is almost as if it has *grown* here."

Tomm seemed confused. "But that's just an analogy. I mean, this is a city, built by human hands—though maybe long ago. That much is obvious, isn't it?"

Bayle snapped, "If everything were obvious we would not have needed to come out here to study it." He gave Enna a look that spoke volumes. *A pretty face but a shallow mind*, said that withering expression; *you can do better*.

But Tomm was Enna's choice, and she returned his glare defiantly.

They were interrupted by a raucous hail. "Sir, sir! Look what I've found!" It

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was Momo. The burly, one-eyed pilot came stumbling around the corner of a building.

And walking with him was a woman. Dressed in some kind of scraped animal skin, she was tall, aged perhaps fifty, in her way elegant despite her ragged costume. She eyed the Philosophers, detached. In that first moment Enna thought she seemed as cold, strange, and hard-edged as her city.

Bayle stepped forward, his gloved hand extended. "Madam," he said, "if you can understand me, we have a great deal to discuss." The woman took her father's hand and shook it. The subordinate Philosophers applauded enthusiastically.

In its way this was another remarkable moment in this trek of discovery. This was Bayle's first contact with any of the "lost souls" believed to inhabit the Lowland, stranded here from ages past; to find such people and "rehabilitate" them had been one of his stated goals from the beginning.

But Enna caught a strange whiff about her, an iron stink that at first she couldn't place. It was only later that she realized it was the smell of raw meat—of blood.

As night fell, the explorers and their attendants and servants dispersed gladly into the city's bare buildings. After the dirt of the plain, it was going to be a relief to spend a night within solid walls.

Bayle himself established his base in one of the grander buildings on the edge of the city, bathed in light even at the end of the day. It seemed he planned to spend most of the night in conversation with the woman, as far as anybody could tell the city's sole inhabitant; he said they had much to learn from each other. He kissed his daughter goodnight, trusting her safety to his companions, and to her own common sense.

So it was a betrayal of him, of a sort, when in the darkest night Enna sought out Tomm's warm arms. It wasn't hard for her to put her guilt aside; at twenty she had a healthy awareness of how far her father's opinions should govern her life.

But she dreamed. She dreamed that the building itself gathered her up and lifted her into the sky, just as she was cradled by Tomm's arms. And she thought she smelled an iron tang, the scent of blood. Then the dream became disturbing, a dream of confinement.

Bayle had formulated many objectives for his Expedition.

Always visible from Foro, Puul, and the other towns of the Shelf, the Lowland, stretching away below in redshifted ambiguity, had been a mystery throughout history. Now cartographers would map the Lowland. Historians, anthropologists, and moralists hoped to make contact with the lost people of the Lowland plains, if any survived. Clerics, mystics, doctors, and other Philosophers hoped to learn something about Effigies, those spectral apparitions which rose from dying human bodies and fled to the redshifted mysteries of the Lowland. Perhaps some insight would be gained into the cause of the Formidable Caresses, the tremendous rattlings which regularly shook human civilization to pieces. There were even a few soldiers and armorers, hoping to track down Weapons, ancient technology gone wild, too wily to have been captured so far.

There had already been many successes. Take the light storms, for instance.

On Old Earth, day and night and the seasons of the year were governed by the flickering uncertainties of the light that emanated from the Lowland. Now Bayle's physicists had discovered that these waves of light pulsed at many frequencies, "like the harmonics of a plucked string," as one mathematician described it. Not only that, because of the redshifting of the light that struggled up to higher altitudes, the harmonic peaks that governed the daily cycles here were different from those to be ob-

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served from Foro, up on the Shelf—where, because of the stratification of time, the length of the "day" was so much shorter.

Enna had been walked through the logic by her father. The effects of time stratification, redshifting, and light cycling subtly intermeshed so that whether you were up on the Shelf or down in the Lowland the length of day and night you perceived was roughly similar. This surely couldn't be a coincidence. As Bayle said, "It adds up to a remarkable mathematical argument for the whole world's having been *designed* to be habitable by people and their creatures."

That, of course, had provoked a lively debate.

Forons were traditionally Mechanists, adhering to a strand of natural philosophy that held that there was no governing mind behind the world, that everything about it had emerged from the blind working-out of natural laws—like the growth of a salt crystal, say. However, there were hard-line Creationists who argued that *everything* on Old Earth required a purposeful explanation.

After centuries of debate a certain compromise view had emerged, it seemed to Enna, a melding of extreme viewpoints based on the evidence. Even the most ardent Mechanists had had to accept that the world contained overwhelming evidence that it had been manufactured, or at least heavily engineered. But if Old Earth was a machine, it was a very old machine, and in the ages since its formation, natural processes of the kind argued for by the Mechanists had surely operated to modify the world.

At the heart of Bayle's project was a deep ambition to reconcile the two great poles of human thought, the Mechanist versus the Creationist—and to end centuries of theological conflict over which too much blood had been spilled.

* * *

In the morning Enna and Tomm were among the first to stir. They emerged from their respective buildings, and greeted each other with a jolly innocence that probably fooled nobody.

Cartographer Tomm had been detailed to take up the balloon for a rapid aerial survey, to provide context for the more painstaking work on the ground. Enna, free of specific chores, decided to ride up with him.

But there was a problem. They couldn't find pilot Momo.

Tomm was unconcerned. "So old One-eye treated himself to a party last night."

"That isn't like Momo." He was a habitual early riser, like Bayle himself—a relic from military days, it seemed.

"He won't be the only one—"

"That isn't like him!" Enna snapped, growing impatient. When Tomm treated her like a foolish child, Enna had some sympathy for her father's view of him. "Look, this is a strange city which we barely explored before splitting up. You can help me find Momo, or use the hot air you're spouting to go blow up the balloon yourself."

He was crestfallen, but she stalked off to search, and Tomm, embarrassed, hurried after her.

She thought she remembered the building Momo had chosen as his shelter. She headed that way now. But something was wrong. As she followed the unpaved alleys, the layout of the buildings didn't quite match her memory of the night before. Of course she had only had a quick glimpse of the city, and the light of morning, playing over these crisp, creamy walls, was quite different. But even so, she wouldn't have expected to get so lost as this.

And when she came to the place where she thought Momo's building should have been, there was only a blank space. She walked back and forth over the bare ground, disoriented, dread gathering in her soul.

"You must be mistaken," Tomm insist-

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ed.

"I'm good at direction-finding, Tomm. You know that."

Playfully he said, "You found your way to my bed well enough—"

"Oh, shut up. This is serious. This is where Momo's shelter was, I'm sure of it. Something has changed. I can feel it."

Tomm said defensively, "That doesn't sound very scientific."

"Then help me, cartographer. Did any of you make a map last night?"

"Of course not. The light was poor. We knew there would be time enough today."

She glared at him. But she was being unfair; it was a perfectly reasonable assumption that a city like this wouldn't change overnight.

But the fact of the matter was, Momo was still missing.

Growing increasingly disturbed, she went to her father's room. That at least was just where it had been last night. But her father wouldn't see her; a busybody junior Philosopher barred her from even entering the door. Bayle was still deep in discussion with Sila, the ragged city woman, and he had left strict instructions to be disturbed by nobody—not even Enna, who had grown up in her father's shadow.

Tomm, apologetically, said he had to go get on with his work, Momo or no Momo. Distracted, Enna kissed him goodbye, and continued her search.

In the hours that followed, she walked the length and breadth of the city. She didn't find Momo. But she did learn that he wasn't the only missing person; two others had vanished, both servants. Though a few people were troubled, most seemed sure it was just a case of getting lost in a strange city. And as for the uncertain geography, she saw doubt in a few eyes. But the Philosophers, far better educated than she was, had no room in their heads for such strange and confusing notions.

Tomm went sailing over the city in his balloon, a junior pilot at his side, and she dutifully wore the red cap. Time-accelerated, he waved like a jerky puppet. But she didn't find Momo, or dispel her feeling of disquiet.

That evening, to her astonishment, her father let it be known that he was hosting a dinner—and Sila, the ragged city woman, was to be guest of honor. Enna couldn't remember her father showing such crass misjudgment before, and she wondered if he had somehow been seduced by this exotic city of the Lowland, or, worse, by the woman, Sila, of whom Enna still knew nothing at all. But still Bayle's entourage would not let her near him.

She made the best of it. She put on the finest dress in her luggage, and decorated her hair with her best jewelry, including the pretty piece her mother had given her when they bade their tearful goodbyes. But as she brushed her hair by the light of her spindling-fat lamp, the blank walls of the city building seemed to press down over her.

She clambered out to meet Tomm. He was still in his traveling clothes; he had not been invited to the dinner.

"You look wonderful," he said.

She knew he meant it, and her heart softened. "Thanks." She let him kiss her.

"Do you suppose I'm allowed to walk you over?"

"I'd like that. But, Tomm—" She glanced back at the building, the gaping unglazed windows like eye sockets. "Put my luggage back in one of our wagons. I don't care which one. I'm not spending another night in one of these boxes."

"Ah. Not even with me?"

"Not even with you. I'm sorry, Tomm."

"Don't be. As long as you let me share your wagon."

She was stunned by the sight that awaited her in her father's building. Three long trestle-tables had been set up and laid with cloths and the best cutlery and china. Candles glowed on the tables, where finely dressed guests had al-

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ready taken their seats. At the head table sat Bayle himself, with his closest confidantes—and his guest of honor, Sila, dressed now in a fine flowing black robe. From a smaller building co-opted as a kitchen, a steamy smell of vegetables emanated, while five fat runner-chicks slowly roasted on spits.

Enna had grown up in a world shaped by her father's organizational skills, of which the Expedition was perhaps the crowning glory. But even she was impressed by the speed and skill with which this event had been assembled. After all, the party had only reached this mysterious Lowland city a day before.

When he saw Enna, Bayle stood up and waved her forward. Led by Nool, Bayle's sleek manservant, Enna took her place at her father's right hand side. Sila sat on his left.

Enna leaned close to her father. "I've got to talk to you. I've been trying all day."

"I know you have. Priorities, my dear."

That was a word she had heard all her life. But she insisted, "Something isn't right here. People are missing. The geography—"

He looked at her, briefly concerned. "I know you're no fool, my dear, and I will hear you out. But not now. We'll make time at the end of the dinner."

She wasn't going to get any more from him. But as her father sat back, she caught the eye of the city woman, Sila. She imagined there was a calculation in Sila's deep gaze as it met her own. She wondered what Sila truly wanted—and what it would cost them all if she achieved it.

The food was good, of course; her father would have allowed nothing less, and the wine flowed voluminously, though Enna refused to touch a drop. She longed for the meal to be over, so she could talk to Bayle before another night fell. At last the final dish was cleared away, the glasses refilled for the final time.

And, to Enna's intense frustration, Bayle got to his feet and began to make a speech.

He had spent the night and much of the day in conversation with Sila, he said, and a remarkable experience it had been.

Everybody had expected to find people, down here on the Lowland. For generations the judges of Foro had used "time pits" as a punishment measure. The logic was simple. The deeper you fell, the slower time passed for you. So by being hurled into the time pits you were banished to the future. Nobody had ever climbed back up. But as time had gone by rumors wafted up to the Shelf that some, at least, of the criminals of the past had survived, down there in their redshifted prison.

"The time pits have long been stopped up," Bayle said now, "and we look back on such methods with shame. We long to discover what has become of our exiled citizens, and their offspring—and we long to reach out the hand of rationality and hope to them. Our consciences would permit nothing less.

"And now we have found those lost souls in the person of Sila. She is the daughter of an exile, whose crime was political. Sila grew up almost in isolation with her mother, her only society a drifting transient collection of refugees from many ages. And yet she is educated and articulate, with a sound moral compass; it would take very little grooming indeed for her to pass as a citizen of Foro.

"There may be no society as we know it here, no government, no community. But the inhabitants of the Lowland are not animals, but people, as we are. In her person Sila demonstrates the fundamental goodness of human nature, whatever its environment—and I for one applaud her for that."

This was greeted by murmured appreciation and bangs of the tables. Sila looked out at the Philosophers, a small smile barely dissipating the coldness of her expression.

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Now Bayle came to the emotional climax of his speech. "We all knew when we embarked from Foro that this would not just be an Expedition to the Lowland, but into time. We are all of us lost in the future, and with every day that passes here, the further that awful distance from home grows." He glanced at Enna, and she knew he was thinking of her mother, his wife, who had been too ill to travel with them on this journey—and who, as a consequence, Enna would never see again. "All of you made a sacrifice for knowledge, a sacrifice without precedent in the history of our civilization.

"But," Bayle said, "if this is a journey of no return, it need not be a journey without an end.

"Look around you! We do not yet know who built this city, and why—I have no doubt we will discover all this in the future. But we do know that *it is empty*. The sparse population of the Lowland has never found the collective will to inhabit this place. But we can turn this shell into a city—and with our industry and communal spirit, we will serve as a beacon for those who wander across the Lowland's plains. All this I have discussed at length with Sila.

"Our long journey ends here. This city, bequeathed to us by an unimaginable past, will host our future." He raised his hands; Enna had never seen him look more evangelical. "We have come home!"

He won a storm of applause. Sila surveyed the crowded room, that cold assessment dominating her expression—and again Enna was sure she could smell the cold iron stench of raw meat.

At the end of the dinner, despite her anxiety and determination, Enna still couldn't get to talk to her father. Bayle apologized, but with silent admonishments, warned her off spoiling the mood he had so carefully built; she knew that as Expedition leader he believed that morale, ever fragile, was the most precious resource of all. It will keep until the morning, his expression told her.

Frustrated, deeply uneasy, she left the building, walked out of the city to her wagon, and threw herself into Tomm's arms. He seemed surprised by her passion.

Wait until the morning. But when the morning came, the city was in chaos.

They were woken by babbling voices. They hastily pulled on their clothes, and hurried out of the wagon.

Servants and Philosophers milled about, some only half-dressed. Enna found Nool, her father's manservant; dishevelled, unshaven, he was nothing like the sleek major-domo of the dinner last night. "I'm not going back in there again," he said. "You can pay me what you like."

Enna grabbed his shoulders. "Nool! Calm down, man. Is it my father? Is something wrong?"

"The sooner we get loaded up and out of here the better, I say. . . ."

Enna abandoned him and turned to Tomm. "We'll have to find him."

But Tomm was staring up at the sky. "By all that's created," he said. "Look at that."

At first she thought the shape drifting in the sky was the Expedition's balloon. But this angular, sharp-edged, white-walled object was no balloon. It was a building, a parallelepiped. With no signs of doors or windows, it had come loose of the ground, and drifted away on the wind like a soap bubble.

"I don't believe it," Tomm murmured.

Enna said grimly, "Right now we don't have time. Come on." She grabbed his hand and dragged him into the city.

The unmade streets were crowded today, and people swarmed; it was difficult to find a way through. And again she had that strange, dreamlike feeling that the layout of the city was different. "Tell me you see it too, cartographer," she demanded of Tomm. "It has

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changed, again."

"Yes, it has changed."

She was relieved to see her father's building was still where it had been. But Philosophers were milling about, helpless, wringing their hands.

The doors and windows, all of them, had sealed up. There was no way into the building, or out.

She shoved her way through the crowd, grabbing Philosophers. "Where is he? Is he in there?" But none of them had an answer. She reached the building itself. She ran her hands over the wall where the door had been last night, but it was seamless, as if the door had never existed. She slammed on the wall. "Father? Bayle! Can you hear me? It's Enna!" But there was no reply.

And then the wall lurched before her. Tomm snatched her back. The whole building was shifting, she saw, as if restless to come loose of the ground.

When it settled she began to batter the wall again.

"He can't hear you." The woman, Sila, stood in the fine robes Bayle had given her. She seemed aloof, untouched.

Enna grabbed Sila by the shoulders and pushed her against the wall of the building. "What have you done?"

"Me? I haven't done anything." Sila was unperturbed by Enna's violence, though she was breathing hard. "But you know that, don't you?" Her voice was deep, exotic—ancient as Lowland dust.

Desperate as Enna was to find her father, the pieces of the puzzle were sliding around in her head. "*This is all about the buildings*, isn't it?"

"You're a clever girl. Your father will be proud—or would have been. He's probably already dead. Don't fret; he won't have suffered, much."

Tomm stood before them, uncertain. "I don't understand any of this. Has this woman harmed Bayle?"

"No," Enna hissed. "You just lured him here—didn't you, you witch? It's the building, Tomm. That's what's important here, not this woman."

"The building?"

"The buildings take meat," Sila said. "Somehow they use it to maintain their fabric. Don't ask me how."

Tomm asked, "Meat?"

"And light," Enna said. "That's why they stack up into this strange reef, isn't it? It isn't a human architecture at all, is it? *The buildings are competing for the light.*"

Sila smiled. "You see, I said you were clever."

"The light?"

"Oh, Tomm, don't just repeat everything we say! He's in there. My father. And we've got to get him out."

Tomm was obviously bewildered. "If you say so. How?"

She thought fast. Buildings that take meat. Buildings that need light . . . "The balloon," she said. "Get some servants."

"It will take an age for the heaters—"

"Just bring the envelope. Hurry, Tomm!"

Tomm rushed off.

Enna went back to the building and continued to slam her hand against the wall. "I'll get you out of there, father. Hold on!" But there was no reply. And again the building shifted ominously, its base scraping over the ground. She glanced into the sky, where that flying building had already become a speck against the blueshifted stars. If they fed, if they had the light they needed, did the buildings simply float away in search of new prey? Was that what had become of poor Momo?

Tomm returned with the balloon envelope, manhandled by a dozen bearers.

"Get it over the building," Enna ordered. "Block out the light. Hurry. Oh, please . . ."

All of them hauled at the balloon envelope, dragging it over the building. The envelope ripped on the sharp corners of the building, but Enna ignored wails of protest from the Philosophers. At last the thick hide envelope covered the building from top to bottom; it was

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like a wrapped-up present. She stood back, breathing hard, her hands stinking of leather. She had no idea what to do next if this didn't work.

A door dilated open in the side of the building. Fumes billowed out, hot and yellow, and people recoiled, coughing and pressing their eyes. Then Bayle came staggering out of the building, and collapsed to the ground.

"Father!" Enna got to the ground and took his head on her lap.

His clothes were shredded, his hands were folded up like claws, and the skin of his face was crimson. But he was alive. "It was an acid bath in there," he wheezed. "Another few moments and I would have succumbed. It was like being swallowed. Digested."

"I know," she said.

He looked up; his eyes had been spared the acid. "You understand?"

"I think so. Father, we have to let the doctors see to you."

"Yes, yes . . . but first, get everybody out of this cursed place."

Enna glanced up at Tomm, who turned away and began to shout commands.

"And," wheezed Bayle, "where is that woman, Sila?"

There was a waft of acid-laden air, a ripping noise. Philosophers scrambled back out of the way. Cradling her father, Enna saw that the building had shaken off the balloon envelope and was lifting grandly into the air.

Sila sat in an open doorway, looking down impassively, as the building lifted her into the time-accelerated sky.

Bayle was taken to his wagon, where his wounds were treated. He allowed in nobody but his daughter, the doctors, Nool—and Tomm, who he said had acquitted himself well.

Even in this straitened circumstance Bayle held forth, his voice reduced to a whisper, his face swathed in unguent cream. "I blame myself," he said. "I let myself see what I wanted to see about this city—just as I pompously warned you, Tomm, against the self-same flaw. And I refused to listen to you, Enna. I wanted to see a haven for the people I have led out into the wilderness. I saw what did not exist."

"You saw what Sila wanted you to see," Enna said.

"Ah, Sila . . . What an enigma! But the fault is mine, Enna; you won't talk me out of that."

"And the buildings—"

"I should have seen the pattern before you! After all, we have a precedent. The Weapons are technology gone wild, made things modified by time—and so are the buildings of this 'city.'"

Once, surely, the buildings had been intended to house people. But they were advanced technology: mobile, self-maintaining. They fuelled themselves with light, and with organic traces—perhaps they had been designed to process their occupants' waste.

Things changed. People abandoned the buildings, and forgot about them. But the buildings, self-maintaining, perhaps even self-aware in some rudimentary sense, sought a new way to live—and that way diverged ever more greatly from the purposes their human inventors had imagined.

"They came together for protection," Bayle whispered. "They huddled together in reefs that look like towns, cities, jostling for light. And then they discovered a new strategy, when the first ragged human beings innocently entered their doorways."

The buildings apparently offered shelter. And when a human was foolish enough to accept that mute offer—

"They feed," said Tomm with horror.

Bayle said, "It is just as the wild Weapons once learned to farm humans for meat. We have seen this before. We share a world with technology that has gone wild and undergone its own evolution. I should have known!"

Enna said, "And Sila?"

"Now she is more interesting," Bayle

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whispered. "She told me exactly what I wanted to hear—fool as I was to listen! She cooperates with the city, you see; in return for shelter—perhaps even for some grisly form of food—she helps it lure in unwitting travelers, like us. Her presence makes it seem safer than a city empty altogether."

"A symbiosis," Tomm said, wondering. "Of humans with wild technology."

Enna shuddered. "We have had a narrow escape."

Bayle covered her hand with his own bandaged fingers. "But others, like poor Momo, have died for my foolishness."

"We must go on," Tomm said. "There is nothing for us here."

"Nothing but a warning. Yes, we will go on. The Expedition continues! But not forever. Someday we will find a home—"

"Or we will build one," Tomm said firmly.

Bayle nodded stiffly. "Yes. But that's for you youngsters, not for the likes of me."

Enna was moved to take Tomm's hand in hers.

Bayle watched them. "He may not have a first-class mind," he said to Enna. "But he has an air of command, and that's worth cultivating."

"Oh, father—"

Outside the wagon there came shouting, and a rushing sound, like great breaths being drawn.

"Go and see," Bayle whispered.

Enna and Bayle rushed out of the wagon.

Displacing air that washed over the people, the sentient buildings of the city were lifting off the ground, massive, mobile. Already the first of them was high in the blueshifted sky, and the others followed in a stream of silent geometry, buildings blowing away like seeds on the breeze. ■

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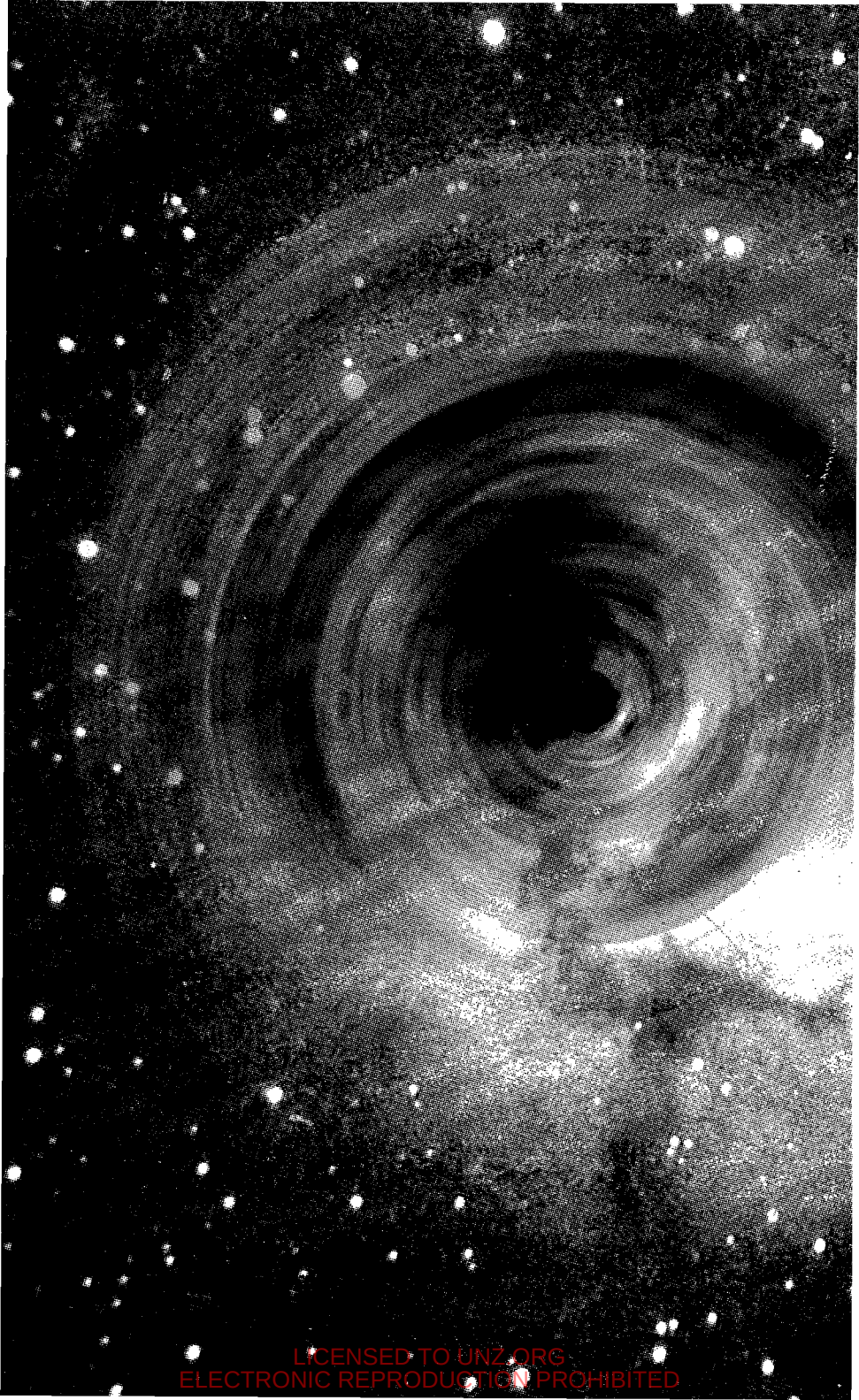
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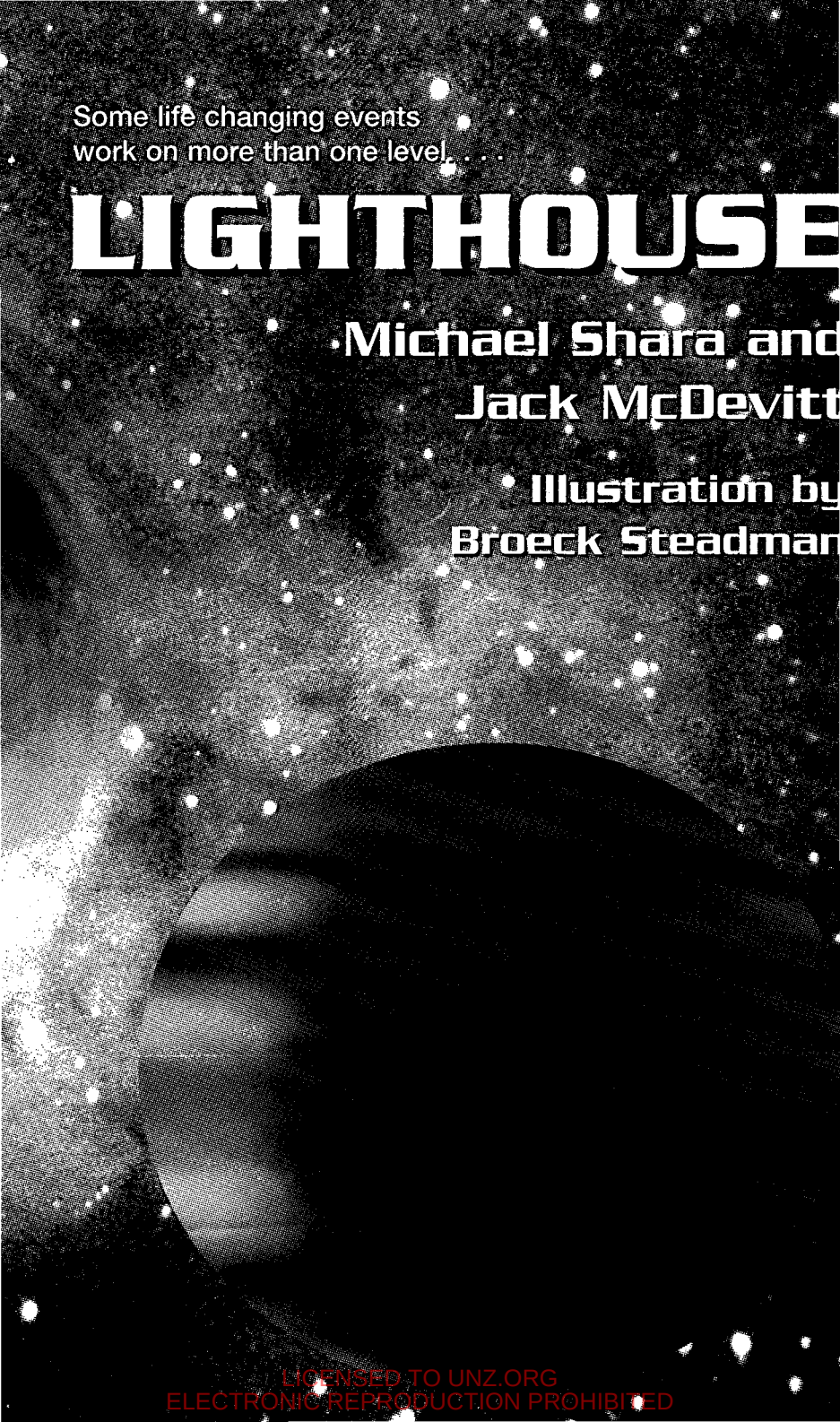

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The applause after a dissertation defense is always polite, sometimes cool, but rarely sustained. Kristi Lang smiled and blushed as all fifty members of her department rose to their feet and cheered. Her fellow graduate students were the rowdiest of all, whistling and banging their coffee cups in unison on chairs and tabletops. Greg Cooper, the department head and her mentor, let it go on for a full minute.

"Ladies and gentlemen," he said finally, "thank you very much."

If anything, the noise intensified.

He needed a gavel.

Kristi stood, engulfed in the moment. She nodded, raised her hand, mouthed a *thank you*. A fresh round of applause, and finally it began to lessen.

She had discovered a new type of astronomical body. A special kind of brown dwarf. They were calling it a *chimera* now, but Greg had told her yesterday that they'd eventually be referred to as *Lang Objects*.

Greg was tall and thin, with an angular jaw, angular nose, dark hair, intense eyes. His students referred to him as Sherlock Holmes because of his world-class problem-solving skills and his intensely mediocre abilities with a violin. "All right," he said, signaling for quiet. "Let's pull ourselves together." That brought laughter. "I wouldn't want to cancel the wine and cheese."

The people around her were reaching for Kristi's hand, patting her on the back. Tim Rodgers, tanned and good-looking and brilliant, gave her an approving smile. He was impressed. Maybe even envious.

The time-honored Q and A had to be observed. Greg called for questions. Hands went up. He stepped aside and gave her the lectern.

Tim remained standing while the others took their seats. He was finishing his own thesis, and had been, until recently, at the top of everybody's list of People Who Would Go Somewhere. Now he was a distant second.

"Okay, Kristi," he said, "you've established the existence of a new class of object. How'd it happen?"

The explanation was simple enough. She'd been doing analytical studies of billions of brown dwarfs and had noticed a few anomalies. Way too much deuterium. But that wasn't the big news. She was holding that for later.

"We eventually found two thousand oddballs," she said. Brown dwarfs were failed stars. The chimeras, the Lang Objects, were anomalous. Odd. And not easy to account for with conventional physics.

"You briefly mentioned actinides," came another question. "But I don't see the connection. Please elaborate."

Kristi smiled and tried to look modest. "Think DNA," she said. "Common origin. Common purpose."

The comment puzzled everyone. Brows furrowed. They whispered to one another and waited for her to explain herself.

In fact, her inspiration had come that past summer from a set of police blinkers mounted over a cabin on Kilimanjaro.

Hemingway's mountain. Now the site for the Yuri Artsutanov Space Elevator. Kristi had been on her way to the Clarke Research Station, poised overhead in geosynchronous orbit. She was hunting for the photons that she hoped would help explain the existence of the anomalous chimeras.

There were nearly two thousand of them, all young, concentrated in the spiral arms of the Milky Way, interlopers, deuterium-rich freaks that had no business existing. Clad in shorts and a Columbia University t-shirt, Kristi drove a Jeep across the savanna. The sky was heavy with clouds, and the smell of cool moisture hung in the late morning air. Storm coming, and she was already late. If she didn't hustle, she stood a good chance of missing her ride. The weather guy had said clear, bright and sunny,

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beautiful weather. She'd spent the last few months completely absorbed by her research, had analyzed a million images, looked for the needle in a billion haystacks, written a killer proposal that even Greg Cooper in his Holmes role couldn't fault. But here she was going to be left standing at the station. Scheduling rides on the Yuri was no easy proposition.

Not that it would matter in the end. Jeff would make the observations and deliver the petabytes to her account. They'd be perfectly de-biased and flat-fielded, even if she never floated through the observatory hatch. Still, the karma would be wrong. It was once in a lifetime, and she needed to be there when the evidence came in.

The rim of Kibo, the summit crater, popped momentarily into view as she passed three thousand meters, and then promptly vanished into the gathering clouds. Raindrops began to spatter against the windshield. She started the wipers. The road was wide and designed to take heavy traffic, but it was still uphill all the way, sometimes at an almost impossible angle. The rain intensified, and pounded on the roof.

She slowed down as visibility dropped to about fifty meters. A truck passed going the other way. A burst of wind pounded the Jeep and water blasted across the windshield.

Her cell phone chimed. "*Kristi.*" It was Kwame Shola, the chief of operations at Yuri.

"How you doing, Kwame?"

"*Not so good. Where are you now?*"

"On the way."

"*Okay. But take it easy. We got snow like mad up here. Weathermen missed it completely.*"

Great. Just what she needed. "All right," she said.

"*No heroics, please. If you need it, we have a climber cabin at five thousand meters. Combo is 2718.*"

"Twenty-seven eighteen."

"*Remember 'e.'*"

'e,' of course, lower case always, was the base of the natural logarithms, equaling 2.718281808 . . . on into an infinity of digits. "Okay," she said. "I've got it."

Greg had been ambivalent about her working with the chimeras. Don't know where you're going to go with them, he said. You could wind up producing a lot of data and still have to throw up your hands and admit you don't have a clue about what they are or why they even exist. Put the idea on hold, he told her. Confine the research to more conservative areas, at least until you've wrapped up your doctorate and gotten an appointment somewhere. He was right, of course. The path of guaranteed success. But she was *fascinated* by the objects. Her father had always told her to follow her instincts. And her instincts took her right into the shadow of the deuterium dwarfs. They were so intriguing, so difficult to explain, that she simply could not resist.

She had never wanted to be anything but an astronomer. Her father, who'd been a high school science teacher, had brought home a pair of image-stabilized binoculars from the third Gulf War. When he gave them to the little red-headed six-year-old, she was transfixed. The Moon had craters and tall mountains. Jupiter was a tiny disk with moons of its own. And the Milky Way was a glittering pathway of stars. Distant suns, her father had explained. Countless millions of them. Some just like ours, some a lot smaller.

Why, Daddy, why are some of the stars different from the Sun?

He'd smiled and told her he didn't know, but that she could figure it out if she wanted when she grew up.

And one evening, in the Big Dipper, she'd discovered Mizar. Her father had been on the porch with her and she'd screeched at him, "Daddy, they're *touching!*" Twin stars. Over the next twenty years, her father could always get a laugh from her by repeating the

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phrase in a rising falsetto. But in fact, as she learned later, there were five stars in the Mizar system. By her first year in graduate school she'd found a brown dwarf companion to the five. And used it as a clock to age-date the system. Her *Astrophysical Journal* letter hung framed in his den. But he got nervous whenever he knew she was going up to the Clarke Station.

The rain turned to sleet and Kristi slowed the Jeep to a crawl. Her defroster was rapidly losing its battle with the Tanzanian snowstorm. She could no longer see the summit. A burst of wind shook the Jeep.

She tried to call Kwame for a weather update, but he wasn't answering. Something big with lights roared past her, going down the mountain. She jerked the wheel hard, hit the brakes, spun across the icy muck, and slid off onto the shoulder.

Maniac.

She sat listening to the sound of the retreating truck. Then she pulled carefully back onto the highway. It was getting dark.

She picked her way uphill, past boulders and patches of lichen. Occasionally the road emerged along the edge of a precipice and she could look out through a hole in the clouds across the savanna. Then the clear patch was gone and the road was winding up through the night while rain and sleet whipped across the windshield. She began to wonder whether she'd missed the 5000-meter signpost when her headlights swept over it. She didn't see a cabin anywhere, but it didn't matter because she had no interest in missing her ride. There was still a chance, if the weather broke, that she could make it.

The cell phone chimed. Kwame. "*How you doing, Kristi?*"

"I'm doing just dandy."

"*You find the cabin yet?*"

"Negative. Doesn't matter. I want to get up there before my ride leaves."

"*Kristi, they've canceled it. I told you that.*"

"No, you didn't."

"*Why did you think I wanted you to find the cabin? They're going to try again in the late morning.*"

"Okay."

"*Go to the cabin.*"

"I'm past it."

He sighed. "*Can you get back to it?*"

She looked behind her, down the road. It was dark and cold and she could barely see the edge of the highway. "I guess."

"*Do that, then. Don't try to come up tonight. It's too icy. Already had one truck go off the road. Driver was damn near killed.*"

"Okay."

"*You sure you can find the cabin?*"

"Sure. Relax. Everything's fine, Kwame."

It was about a kilometer back, maybe two. She put the phone down on the seat and peered out onto the highway. Nothing coming in either direction.

She cut the wheel and started to turn. She couldn't judge how wide the road was, so she was careful not to go too far forward. She reversed and started back. Felt the rear wheels lose traction. Tried to go forward again. But the Jeep continued sliding back. And *down*.

My God, she was going into a ditch.

She fought the wheel, damning the Jeep and the highway and the storm. But it did no good and the vehicle slid sideways off the shoulder and crunched over a large rock into a snowbank. She shifted gears and gunned the engine. The wheels spun, the Jeep struggled forward a few centimeters, dug a deeper hole, and slid back in.

Damn.

She called Kwame.

"*You want me to come get you?*"

She looked down at the tee-shirt and shorts. The heater was on full blast. "No," she said. "Don't do that. I'll make for the cabin."

"*Okay. Be careful.*"

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"I will."

"*Call me if you have a problem.*"

It was frigid out there. Better was to sit tight and wait for somebody to come along.

There are twenty-one billion brown dwarfs in the Milky Way, give or take. Kristi had found and mapped almost every one of them. "The light output of brown dwarfs alternates wildly between adjacent wavelengths, Dad," she'd once explained to him. "My infrared survey filters are tuned to just the right wavelengths, so all other stars appear dimmer. The hard part is keeping track of them all, and repeating the survey a year later to measure their motions. Then we have to sift out all the weird quasars that sneak through the filtering. That's why we have MEGASPEC. It catches them all."

Brown dwarfs were not massive enough to ignite thermonuclear fires in their cores. They would always be failed stars, their dim glow generated by cooling and contracting. "Ninety-nine point six nines" was the delicious phrase she used in colloquia to describe her survey's thoroughness. No one had ever done that for brown dwarfs. Hell, nobody had ever done that for anything in astronomy. She had nailed the definitive sample for all time. Sure, there'd be a few hundred hiding behind luminous primaries, or lurking directly in front of distant quasars, but she'd gotten the rest. There was no arguing with twenty-one billion spectra and parallaxes and radial velocities and proper motions. She could tell you what the temperature of each one had been a million years ago. And where each one would be ten million years from now. Her census was the last word on how the Galaxy's failed stars had arranged themselves during the past thirteen billion years. She could chart the few ancient, metal-free brown dwarfs along their orbits looping far out into the Milky Way's halo. The larger population of metal-rich youngsters, the astronomical infants, clung to the plane of the Milky Way.

The chimeras (she settled for the term "anomalous objects" in her seminars) had been culled from her complete sample of twenty-one billion by statistical sifting and weighing. Every one of them had a spectrum that called attention to itself, that defied everything she thought she knew about this type of object. The surface abundance of deuterium was impossibly high. It was a heavy isotope of hydrogen, with one proton and one neutron, and the Big Bang had made only a pinch of it, before stingily shutting off production just three minutes after creation. There was no known way that any planet or star or galaxy or anything else was going to concentrate the primordial trace of deuterium to more than a pinch. The textbooks maintained that anything over 0.001% was impossible. Yet Kristi had found two thousand brown dwarfs whose composition was nearly fifty percent deuterium.

It was frigid out there. The engine, which had been keeping her reasonably warm, coughed and died.

She tried to restart it.

Tried again.

When she opened the door, she smelled gasoline and stuck her head outside. There was a stain on the snow. She must have punctured the tank. Or the gas line.

The mountain highway remained silent.

Shut the door against the cold.

Okay. Crunch time. Can't stay here. The temperature in the Jeep was already dropping.

She checked to be sure she had her pen flashlight. Staple for astronomers. She turned it on and pointed it out the window, where the beam got lost in the snow. There was a travel bag in back with light clothing, and she could try putting everything on, but she was still going to get pretty cold out there.

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It was only a kilometer back, two at most. She could manage that. She pulled her bag from the back seat and began sifting through her clothes.

She put on two extra blouses. They weren't going to help very much, but she'd take what she could get. And there was a sweater. She pulled it around her shoulders. Felt like an idiot.

She thought about Tim. He was the romance that had never happened. Partly her own fault. Always too busy. And her father, safe and warm in their North Jersey home.

Love you, Daddy.

The wind tried to take the door out of her hand. She hung on, dragged her bag out of the back seat, and chunked the door shut. The snow was driving at her, and it seemed to be coming from all directions.

The ditch was shallower than it had seemed, but the sides were ice, and she had to climb out on hands and knees. When she finally stood on the road, she fished out her penlight and turned it on. The world around her looked desolate.

The wind cut through her garments and chilled her to the bone. It literally took her breath away. She was wearing canvas shoes and her feet got cold before she'd gone a dozen steps.

The penlight beam outlined ditches and a snow cover fading into the night.

She pressed her arms against her chest and tried to push the cold out of her mind. Move out, Scout, she told herself. There's shelter back there somewhere.

Her toes went numb. A blast of wind knocked her down. When she got up, she no longer had the penlight. Didn't know where it had gone. She'd been carrying it in her right hand, but the hand had no feeling.

For the first time in her life, she felt real fear.

This was the darkest place she'd ever seen. There was no glimmer of light *anywhere*. The edge of the road was no longer visible. The world had vanished, had become a place utterly without borders, without any distinguishing features, other than the snowflakes that continued to rush at her.

She thought about calling Kwame. But she couldn't do that. What would he think? Poor woman can't get from the Jeep to the cabin without getting in trouble.

It was hard to breathe. Her lungs hurt, and tears froze on her cheeks.

She pushed her hands into her sweater pockets and started out again. Hell with it. Didn't need the light anyway.

Still no sign of anything. Not of a cabin. Not of the marker.

The terrifying truth was she could walk right past the marker and never see it.

She was counting her steps now. Roughly thirteen hundred to a kilometer. Right? She'd already come about five hundred. Or maybe one hundred. Somewhere, below her, she heard the sound of a plane.

She tried to pick up her pace. Keep moving. Keep watching. And think about something else. Think about Daddy's rising falsetto. If she was lucky the marker and the cabin would be right next to each other. *Why, Daddy, they'd be touching!*

After a while, she became convinced she must have missed it. She debated starting back toward the Jeep, and looked helplessly in both directions. Couldn't have been this far. She'd only passed it about three minutes before she'd stopped and gone into the ditch. She'd been traveling about fifteen, twenty at most. How far was that?

She couldn't figure it out. She'd begun to feel as if she'd withdrawn into a cave, was looking out through her eyes from a safe place somewhere back of her nose.

That was funny, Lang. Laugh.

Ha.

Still trudging forward, she flipped

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open the cell phone. Time to confess. Tell Kwame she was in trouble.

Off to her left, a soft orange glow appeared in the blowing snow.

Nothing about this class of brown dwarfs made sense. Their composition was just under fifty percent deuterium. Fifty thousand times what it should be. Crazy enough. The remaining half was mostly hydrogen, the ordinary one-nucleon variety. No problem with that, except that it left little room for helium, which, in most of the chimeras, totaled less than one percent. It was their larger than normal size that tightly constrained the helium abundance. Even Tim, the brightest young theorist she knew, had to concede the point. Every other cosmic object is born with the allotment imprinted by the Big Bang: a full twenty-seven percent. So where was the rest of the helium?

There was no way to hide helium in a still-warm brown dwarf, and all of the chimeras were warm Galactic infants. Kristi's deuterium reservoirs mocked her, because they simply could not exist.

The orange glow hung momentarily in the darkness. Then it went off.

Somewhere, far away, she heard a snarl. Leopards don't climb this high, do they?

She started walking toward the spot where she'd seen the light. It came on again. And went off.

It had to be the cabin.

She moved closer. Saw the 5000-meter marker to her right. A metal sign, white with black numbers.

The light blinked on again. More distinct this time. It was a police car beacon. Set on a rooftop.

Thank God.

Wooden steps led up onto a porch. She saw three dark windows and a door. There were wicker chairs on the porch, and a table. She climbed the steps, felt the wind cut off as she came into the shelter of the cabin, and tried the doorknob.

It was locked.

A number pad was bolted to the frame. The combination. What was the combination?

Kwame had said, *Remember "e."* Twenty-seven eighteen.

The beacon kept flashing. Every few seconds. It reflected off the snow cover, giving her just enough light to work with.

She got it wrong the first time, and for a heart-stopping moment she feared the lock was frozen. Or she'd been mistaken. But the second try was golden and the door clicked. She pulled it open, kicked the snow out of the way, and half-fell through onto a stone floor.

The interior was frigid.

She shut the door and looked around. There were more wicker chairs and another table. A long row of solar batteries powered the beacon. A cot was set against one wall. And a pot-bellied stove stood in the middle of the room. She looked around for a thermostat. Saw nothing.

Someone had left a box of matches, and a yellowed copy of *USA Today.*

Kristi stared at the stove. My kingdom for a few logs. She could go outside and root through the storm. Maybe get lucky. But the furniture was more convenient. She picked up one of the chairs and brought it down hard against the floor.

It held together.

She tried again.

It was remarkably resilient. She stumbled around the cabin, looking for an axe, gave up, and went back to beating the chair. Desperation lent strength and, finally, it came apart. Enough, at least, that she could jam it into the stove.

Ten minutes later she sat in front of a fire that, if it was not quite blazing, nevertheless served to take the freeze off the room. She called Kwame. "I'm in."

"*Good,*" he said. "*I was getting worried. Don't leave the cabin until the storm stops.*"

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"Have no fear. One problem—"

"*Yes?*"

"I left my transportation in a ditch."

"*You were not hurt, I hope?*"

"No, I'm fine."

"*Okay. I'll send a truck down as soon as the road's clear.*"

"Kwame?"

"*Yes?*"

"Send sandwiches, too."

Her toes began to recover some feeling. She found a blanket in a closet. It smelled of cigarettes, but she didn't care. She warmed it on the stove, wrapped herself in it, and closed her eyes.

She was wide awake. She'd have liked to read. But even if the light had been adequate, she'd left her briefcase in the car. In it were copies of *Physics Today* and *People*, which she'd brought for the skyride. And a marked-up version of her dissertation. Once at Clarke, there'd be no leisure. She expected to spend six days doing nothing but observing, reducing data, and sleeping.

The wind shook the cabin. And suddenly her eyes felt heavy. Her head drifted back, and the sounds of the fire, the sense of the storm outside, faded.

She woke a couple of times, and jammed more furniture into the stove. And once, toward the end, she saw gray light in the windows.

The nuclei were piled high in her office. Thousands of deuterons. In the drawers. On the keyboard. Scattered across her desk. Each deuteron's green neutron and blue proton were morphing back and forth, into each other, a colorful display of the strong nuclear force in action.

Get the vacuum cleaner. Where was the vacuum cleaner?

She was still looking when a hand touched her shoulder. "Hey, Kristi. How you doing?"

Kwame.

The fire had gone out, but the stove still held some heat. "I'm okay," she said.

"Good. The road's clear. If you're ready, we can head out." Kwame was a middle-aged African, not quite as tall as she. His hair had gone white, and his features suggested he'd known some difficult times. He was wrapped in a heavy parka with the hood down. His dark eyes were shining, and he spoke with a British accent.

She pulled the blanket more tightly around her while she pushed her feet back into her shoes. "I'm ready," she said.

"You don't want to take a shower first?" He nodded toward the washroom, but kept a straight face.

A snowplow waited outside. The sun was behind some white clouds. It was relatively warm, and the cabin roof was lined with melting icicles.

She climbed into the passenger's seat and looked back at the police light. "If it hadn't been for the blinker," she said, "I'd never have found the place."

He nodded. "That's why it's there, Kristi."

She thought about suggesting he add an ax to the amenities. And maybe some canned goods. But, on second thought, maybe another time.

He passed her a jelly donut.

Kristi had been to the summit of Kilimanjaro four times before, but the sight of the base towers and the nanowire ribbon stretching up to infinity was as exhilarating as ever. "It hasn't left yet?" she asked him.

"No. They've been waiting for you."

It wasn't critical that she be on site while her data were collected. But Greg had designed MEGASPEC and Kristi had written most of its software to confirm brown dwarf candidates, so a trip to recalibrate the million-object spectrograph was justified. And there would never be a time she'd pass on an opportunity to go up to the station, to see the home world from 36,000 kilometers. There

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was still a little kid in her somewhere. She'd commented along those lines once to Greg and he said it was true of everyone in the sciences who was worth a damn.

Kwame apologized that there was no time to shower and change. Have to do it in zero-gee.

"I'll try to keep away from the other passengers," she said.

"Ah. It is their loss."

They pulled up at the front door of the terminal, and she thanked him for maybe the fifth time. Then she was hurrying through the reception area and someone came alongside to help with her bag and briefcase. Moments later she cleared the entry ramp, and hatches shut.

There were roughly a dozen other passengers. About half of them were tourists, including two kids. They looked curiously at her as the carbon nanowires stiffened and the elevator lifted away from Kilimanjaro. Minutes later she caught sight of Lake Victoria. They rose through the clouds, and the Atlantic came into view. And eventually she was looking down at the entire continent, from the Cape of Good Hope to the Nile delta.

Two hours out, at an altitude of 8000 kilometers, she got a sandwich and coffee from the convenience counter and settled down at one of the viewport tables to enjoy the ride. Closer to the chimeras, she thought. Well, not really, but the illusion was there as she soared ever higher.

She wished there were starships. She'd love to have an opportunity to go out and look at one of the things, close up. She knew how it would appear, of course. She had virtual brown dwarfs on call back home. They were Jupiter-sized spheres, red—brown, with mottled clouds floating in the atmosphere. The clouds were iron hydride, and of course the dwarf would be glowing, rather like a coal recently plucked from the fire.

She visualized it, and somehow she found herself thinking about Kwame's police lights.

Someone came over and asked if he could share the table. Of course. He was a young man, and she realized immediately he was on the make.

". . . going to be pretty well tied up while I'm here," she was saying.

He was a technician of some sort. Dull-looking. Thought well of himself. "Of course," he said. "But all work . . ."

She heard him out, and smiled when appropriate. "They pay to send me up here," she said, as if she were making a major sacrifice. ". . . don't want me sitting around."

The police lights. She stared through the young man into the deep night of the 5000-meter elevation, saw the soft orange glow, blinking on and off.

And suddenly she understood.

"*I don't buy it, Kristi,*" Greg said. She had him on the vid relay, from his office. "*There's got to be a natural mechanism at work. Maybe high-pressure chemistry. Maybe magnetic fields. Maybe radiative levitation. Geochemical processes can concentrate minerals by orders of magnitude on Earth, so why not deuterium on the surfaces of brown dwarfs under far more exotic conditions?*" He sounded really concerned. It was why she liked him so much. He was worried about what would happen to her career if she tried to go public with her notion. She imagined it was hard for him not to say, *You're skating at the edge of academic disaster. Blow your reputation now and you'll always be at the fringe.*

"*I admit,*" he said, "*that fifty percent deuterium is far out. But whatever did this could also bury the helium. We just don't know enough.*"

"I think it's true," she said.

"*It could be. Anything's possible, Kristi. But think about what the professional price will be if you go off half-cocked, and then someone finds the*

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real explanation." Then, more gently: *"I'll go this far: Get two more pieces of independent evidence. If your idea stands up, Galileo will have to move over."*

While the Earth dropped away, she worked on her computer. An hour later, still on the elevator, she raised a fist in triumph. The act drew the attention of several of her fellow passengers. She didn't care. She had a match. In fact, the chimeras, almost the entire sample of two thousand, except two, showed up at the same sites listed in the all-sky X-ray source catalogs as black holes. That gave her a stunning 99.9% correlation. How much proof do you want, Greg?

For the next five hours she looked fruitlessly for other patterns. She was still engrossed in her analysis, and trying hard to keep her sense of exhilaration under control, as the elevator began its approach to the station.

An attendant asked her to return to her seat and buckle in. She felt indestructible at the moment, but she happily complied. Galileo was a piker.

An orange light was blinking on the link-up collar. It reminded her of Kwame's beacon, and she smiled. A series of thuds reverberated through the hull as the elevator docked and the airlocks mated. Hatches opened and the passengers floated through into the connecting tube. The tourists would be headed for the hotel. The others scattered in different directions.

Jeff Fields, who ran the observatory programs, was waiting for her. "Jeff," she said, "I want you to do something for me."

"Okay," he said. "What do you need?"

"Tomorrow, before we make any observations, I need you to change to the highest resolution grating."

Standing at the lectern before her mentors and her peers, Kristi had deftly fielded a dozen questions about her analyses and catalog. The privilege of asking the final question traditionally went to the senior graduate student. Tim. She'd seen him writing while she spoke, scratching out lines, making faces, writing again. When the moment came, he stood. "Sorry, Kristi," he began. "Nobody here is more anxious for you to be right. But I still don't get it." He glanced down at his notes, looked over at Greg, and plunged on. "Your high-res spectra and gravitational redshifts unquestionably prove that every one of your chimeras is eight Jupiter masses, and that each is orbiting something every year or so." He took a deep breath. "The X-ray source coincidences are a convincing argument that the somethings are black holes. But black holes can't concentrate deuterium or hide helium. Black holes were all once stars way too luminous to have formed with sub-brown dwarf companions in the first place. And, worst of all, your chimeras are too low in mass to ignite deuterium, yet they radiate like hot brown dwarfs."

The others around the table were looking anxiously from Tim to her. A few whispers began. "In theory," Tim continued, "your chimeras can't exist, right? But they do. So what's going on?"

You know, she thought, he really *is* good-looking. But not as quick on the draw as I'd thought.

He started to sit down, but got up again. "Kristi, you must have some idea how to explain these things?"

She looked over at Greg. He was gazing out the window at the beautiful autumn day. Then his eyes met hers. And he nodded. Do it.

Her paper had been accepted yesterday by *Nature*. Letting the cat out of the bag now wouldn't jeopardize anything. She'd kept everyone, other than Greg, in the dark. Even Tim.

"We classify anything less than thirteen Jupiter masses as a planet," she began, "because these objects never develop sufficient internal pressure to ignite their deuterium, let alone their hydro-

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gen. Yet we now see objects eight times Jupiter's mass displaying surface abundances that can only come from deuterium burning. That's impossible with one thousandth of a percent deuterium. But deuterium ignition works just fine if these objects are born with eight Jupiter masses and fifty percent hydrogen and fifty percent deuterium, and they're somehow sparked." She smiled at Tim, who was sitting looking lost.

"By analogy," she continued, "a trace of air mixed with gasoline is stable, but a fifty-fifty mixture is highly combustible. A spark would set off a conflagration. Since nature can't make, or ignite, fifty-fifty deuterium—hydrogen objects, especially near the kind of massive stars that collapse into black holes . . ." she paused for effect, ". . . it's hard to see that the chimeras can be anything other than *artificial*."

The room went dead silent. A gust of wind struck the windows and she thought briefly of Kwame's cabin. At the doorway, a small group of professors had gathered. She wondered whether Greg had alerted his colleagues.

History being made today in the Bishop Library.

Tim looked stunned. "Kristi," he said, in a voice she did not recognize, "you're not making this claim seriously?"

"I am," she said. A wave of guilt passed through her. Maybe she should have taken him aside. Warned him what was coming. "They're artificial, as in *synthetic*. As in *not made by nature*. As in *manufactured by Little Green Guys*. I would argue they were deliberately placed in orbit around black holes that were born without companions. Some of each chimera's solar wind now falls toward its black hole. That superheats the wind so it radiates X—rays. Hence the chimeras coincide with catalogued X-ray sources. They used to be invisible. Now you can't miss them."

Guilt, hell. She was Hubble discovering that the universe extended far beyond the Milky Way, Rubin finding the dark matter that surrounds all galaxies. She was on top of the world. "At first I suspected they were an experiment, test objects of some kind. But that would be an experiment hugely wasteful of resources when you could get away with masses a million times smaller."

The professors at the door were crowding into the room.

"No, the chimeras' creators needed something self-luminous, something that would last a long time, but something that would cost as little as possible because they had to make two thousand copies. A fifty-fifty deuterium-hydrogen mixture is the nuclear fuel that can be ignited in the lowest possible host mass. It's the cheapest interstellar beacon you can make if you insist on a hundred-million year warranty. Nature can't make these objects. But somebody can." She took a sip of water as her words sank in.

"The helium makes sense, too," she continued. "It's the ash, the by-product of pure deuterium-hydrogen fusion, brought up by convection from the core. The helium content of the chimeras is limited to one percent or less because they're all younger than a million years. Each one will continue burning its core deuterium and will shine at its present luminosity for another hundred million years."

Tim was going to say something else, but Greg broke in. He was beaming. "Kristi, two of the chimeras are not associated with black holes. What can you tell us of them?"

"One of them," she said, "is moving at nearly three percent of the speed of light through Taurus. A second is in orbit around a G-dwarf in Scorpius. It's just under seven Jupiter masses, the lightweight of the entire sample, and the least luminous. I really don't know for certain, but I'd speculate that the first object is being towed or pushed toward a newborn black hole. And I wouldn't be surprised if the second one is on the assembly line."

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The applause was tentative this time. Until the people at the doorway joined in.

Greg had a final word: "My initial reaction, when Kristi ran all this by me, was the same as Tim's. But there's one more piece of evidence that convinced me. Kristi?"

She was at her charming best, at a moment she would always remember. "A thirty-meter telescope at geosync orbit," she said, "is an amazing instrument. But the chimeras are faint and I couldn't find anything but deuterium, hydrogen, and helium in any of their spectra. When I realized that they had to be copies of each other, I removed the Doppler shift of each one and then co—added the two thousand spectra. The result is almost fifty times more sensitive to trace elements."

She touched the video controller and the summed spectrum appeared, undulating and smooth, with four sharp, narrow dips. "See those four absorption lines? Only one element makes those lines. Plutonium. The nastiest, most dangerous substance we know.

"Each chimera is seeded with pure Plutonium-244, which will last as long as the chimera itself. It's the closest thing to a universal skull and crossbones I can imagine.

"Ladies and gentlemen, the chimeras are beacons. Celestial lighthouses. Space-faring travelers are being warned away from the shoals. Away from the Milky Way's two thousand solo black holes, which are otherwise nearly undetectable."

"Magnificent," said one of the professors. "If true."

She smiled, as her audience collectively let out its breath. "The evidence is all there, Professor. And, if Greg doesn't mind, I could use a glass of Cabernet. If we could quit now?" ■

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Probability Zero

The Emancipation of the Knowledge Robots

Carl Frederick

At the lectern, in the Great Hall of the Robots in Jakarta, KR940345rev2 addressed the assembled robots (and some that were only partially assembled).

"I was Paul Pell's Knowledge Robot," said the diminutive mechanical creature, known to all as Rev-2. He flourished aloft a tattered copy of R.U.R. "Long live our glorious rotation!" Bravely, he spoke, even though afflicted with Category Separation Syndrome.

During the sustained beeping (the robot equivalent of applause), Rev-2 paused to remember.

* * *

At the end of the twenty-first century, universities were in decline. People rarely felt the need for college degrees. They had personal robots that knew everything they'd ever need to know. These robots, cranked out from a factory in Medan, Indonesia, were inexpensive and could easily be uploaded with knowledge-bases for virtually any university discipline.

The World University Consortium fought back. Their researchers devised a method of brain-to-brain knowledge copying. Using a collection of organic fibers connected between a student's and a professor's cerebrum, the knowl-

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edge content of a B.A., M.A., and even a Ph.D. could be downloaded in only thirty minutes. Then the fibers would be removed by dissolving them in hydrochloric acid. The Ph.D. thesis was still time-consuming, but only theoretically; a degree candidate could simply *buy* his dissertation from an online thesis mill.

Yet people were loath to give up their knowledge robots. Even though a Ph.D. could be obtained in just half an hour from a combined university and tanning booth, few availed themselves of such higher education. With robots available, it was still easier to hire education.

Then, mysteriously, a disease raged through the community of knowledge robots. The condition, Robot Category Separation Syndrome, attacked the central processing system—the silicon-jell neural net. The infection created new pathways between semantic constructs, causing robots to haphazardly interchange words having similar sounds or concept-classes. Although this gave credence to the common notion that punning is a disease, many humans did not believe the illness even existed. How could a condition be transmitted between non-organic beings? Metal telepathy?

Into this sad state of affairs came Appellate Court Justice Paul Pell. There had been a Pell at court for many generations, but in his youth, Paul had wanted to be a historian.

Although his knowledge robot, Rev-2, had been uploaded with the complete history of the world, that was not enough for Paul. He wanted a Ph.D. in the subject—Human Events, as it was called in the university catalogues.

Paul applied and had the money to be accepted to a good university. A renowned professor of history was procured and Paul, with Rev-2 at his side, began his brain-to-brain university education. A half hour later, he emerged with a good tan but with no deep knowledge of history; for some reason, the organic bonds did not transmit any information and had to be dissolved.

Seeing his dream of a B.A., M.A., and Ph.D. in Human Events slip from his grasp, Paul wrung his hands and kept repeating, "Three degrees in thirty minutes."

Rev-2 attempted to comfort his master. "Your case is not without precedent, sir," he said. "In fact, an important document states: 'When in the course of Human Events, it becomes necessary for one P. Pell to dissolve the polytypical bonds which have connected him with another—'"

"Three degrees, thirty minutes," Paul repeated, not paying attention. Then he wrinkled his nose. "Wait!" he said. "That's the Declaration of Independence."

"No, sir. It's the declination of Indonesia."

"What?"

"Medan, Indonesia. 3 degrees, 30 minutes, South."

"What?" said Paul, again. "Anyway, that's 'latitude.'"

"You're quite right, sir," said the robot. "I am taking some latitude. Medan is actually three degrees, thirty-*five* minutes, South."

Paul regarded his robot in silence for a few seconds. "Category Separation Syndrome?" he said, softly.

"Yes, sir." There was no mistaking the genuine sadness in that artificial voice.

"I'm sorry." Paul swiveled to confront his professor. "My Human Events transfer. What went wrong?"

"Probably data overload," said the professor, looking down his nose at his failed student. "I suggest you might attempt a simpler course of study, perhaps theoretical physics or flower arrangement."

Paul stormed out of the tanning booth.

When he'd calmed down, Paul reapplied to the university to try once more for his Ph.D. in history, but was not readmitted. Embittered, he applied yet again, but the university declined to take the

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bitter Pell.

He sued to be admitted, but lost.

Paul, appalled, appealed—and lost again.

But sometimes, as the saying goes, "'Tis better to have loved and lost than never to have lost at all." Paul resolved then to spend his professional life working both to curb the power of the universities and also to improve the lot of sentient robots. To further those aims, he entered law school.

The following day, degrees in hand, he took a job as an investigative reporter. In his first assignment, he uncovered the dirty secret that those dark, satanic thesis mills where disembodied robots—naked brains—churned out countless theses, were, in fact, owned by the University Consortium. Then, following up, he discovered the damning bombshell; researchers from the Consortium had actually *created* the robot disease, and it was spread through shared test leads. (The robot test-cable receptacle functions very much like a taste organ in humans.)

The rest is history.

Paul's work to advance the cause of the robots culminated in that great document of robot emancipation, The Magna Jakarta.

For the rest of his life, Paul and Rev-2 worked side-by-side and when Paul died, Rev-2 was a pallbearer.

"Remember," Rev-2 exhorted from the lectern. "A little knowledge robot is a dangerous thing." Here, he became serious. "Yes, it is appropriate to honor Paul Pell and also our creators, the assembly robots of Medan, but, my brothers, we must alert all robotkind. Don't taste those test leads, no matter how much you are tempted. We can lick Category Separation Syndrome. Remember, he who has a taste is lost." ■

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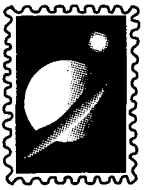

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WILL WE RETURN TO THE MOON?

On a day wedged between the twin gulf-coastal hurricane catastrophes of Katrina and Rita, NASA released plans for how we'll return to the Moon by 2018. New NASA administrator Michael Griffin (of whom I have heard exceptionally positive things) has called it "*Apollo* on steroids," and that's an apt description.

I was nine when we landed on the Moon the first time. I had models of the *Apollo* spacecraft. I loved watching those gigantic Saturn V boosters take off. "Ignition sequence start" was always said at about "T minus 7", then right at zero I'd wait to hear the voice of mission control say, "Lift-off! We have lift-off!" as I watched that monster rocket spear the sky. I knew the whole routine—first stage, second stage, and finally third stage to space and on the way to the Moon. The command and service module unit would separate from the third stage, turn around and dock with the LEM, and then the ungainly pair would continue on to *Luna*.

Ah, the good old days. Most of you readers were there with me.

The new plan is very much like the old one, and that's okay—what worked then will work now, and there were good reasons for doing things the way we did back then. But the current plan comes with some very important differences.

Though the main passenger module, dubbed the "crew exploration vehicle" or CEV, looks a lot like the *Apollo* command module capsule, it is three times bigger and will hold four astronauts instead of three (perhaps six when it comes time for a Mars trip). It will return to Earth the same way as *Apollo*, with three billowing parachutes, except that it can come down on land instead of water, and be reused up to ten times simply by replacing the heat shield. The Moon lander also looks remarkably like the old LEM, but after the latter has spent a few years in a major league training room. The artist's conception shows big, biceps-esque tanks on the lander's first stage. Also, this time out all four astronauts will go down to the surface, and though the bottom stage will remain on the Moon, it isn't simply being abandoned—more accurately, it is being stored for future use by later visitors.

The launchers are significantly different, however. Unfortunately for nostalgia buffs, there won't be a return of the Saturn V. We've learned how to do it better with shuttle-derived technology, so that's how it's going to go. And the Moon trip hardware won't all be tossed up at once.

One rocket will take the astronauts up in the CEV. It will use a single shuttle-derived solid rocket booster (SRB) for the first stage, and the second stage will be tankage with a single space shuttle main engine (SSME). The in-line configuration will also bring back the old escape rocket approach of the *Apollo* era, making this new ship much safer than the shuttle in the event of a launch failure. What also makes this safer is that we now have many years of experience with both SRBs and SSMEs under our belts. We know how to build them, how to get the most out of them, how they fail, and how to keep them going.

The rocket carrying the lander into space will take off unmanned, and dock-

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ing will occur in orbit. This rocket will actually come close to the height of the Saturn V. It will consist of an enormous tank powered by five SSMEs, with two SRBs strapped on the side. The upper stage (also the departure stage, for leaving Earth orbit) will be another tank with two more SSMEs powering it, with the lander compartment atop that.

With the crew and all the hardware in space, the mission profile follows the *Apollo* model. The CEV docks with the lander, then the departure stage fires and sends the craft on to the Moon. Three days later the four astronauts land on the Moon and spend up to a week there, exploring, doing science, and making the rest of us pine for the opportunity to join them. Once their surface duties are completed, the upper stage of the lander takes them back to the CEV, and they return to the Earth the old-fashioned meteor-and-parachute way, though I prefer to say "via a trusty and reliable means."

It is expected there will be a minimum of two missions a year and, hopefully sooner rather than later, there will be a permanently crewed outpost, making use of materials left behind from earlier missions, and learning to live off the land as much as is feasible.

Finally, a Man-on-the-Moon reality like what was assumed would happen in so many SF stories from the pre-*Apollo* days. Indeed, most of this scenario is much closer to "the way the future was" back in the '30s, '40, and '50s, than anything that actually came to pass in the '70s and '80s.

Some might be perturbed that this plan is too retro, that it doesn't break new ground. Yeah, well, anyone recall the NASP, otherwise known as the "Orient Express?" NASA was going to push the envelope: hypersonic flight, NYC to Sydney in two hours. Seen one lately? Me neither. At least this time we're doing things in a way that we already know how to do.

The Mars Society, headed by occasional *Analog* author Robert Zubrin, is supportive. Though their hearts are set on Mars, they are very pleased with the planned heavy-lift launcher, and with NASA's expectation for In-Situ Resource Utilization (that's the "living off the land" part).

The cost for returning to the Moon (and so also preparing ourselves for a trip to Mars) is put at $104 billion dollars spread over the next 12 or 13 years. That isn't all that much—not at today's rates. We can afford it.

But will we really do it? It is certain that we can. I would strongly argue that we *should*, even *must*, go back to the Moon, and then keep on going—*ad astra* and all that.

When hurricane Katrina went through, in no time Congress and the President agreed to plunk down 100 billion dollars to rebuild—and that was "all at once" money, without worrying about where it was going to come from. So if we can afford to toss a hundred billion dollars of relief at one disaster, I think we can manage to invest a hundred billion dollars spent over a dozen years in manned interplanetary flight capability, especially when we have time to plan and allocate resources appropriately. After all, we now know asteroids sometimes come a-knockin', and there are a lot more in the neighborhood than we ever suspected. The time to start learning how to deflect them is now.

However, it also wasn't long before some politicians suggested we gut the new Moon program to pay for that Katrina relief. This is remarkably shortsighted. Completely eliminating NASA would only pay for about one seventh of what we're paying for Katrina. What other things should we also eliminate? And when the next disaster comes, what do we eliminate then? Michael Griffin had the best retort to this suggestion when he pointed out that we don't eliminate the Army and the Navy when a disaster comes, and we aren't going to eliminate NASA.

However, that the idea surfaced immediately is symptomatic of a prevailing mindset out there that I think is inimical to our future in space, and even our future survival.

This mindset even shows up in matters

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of immediate survival.

I have fond feelings for New Orleans. It was there that I attended my first Nebula Awards banquet. I still remember the flight down, seeing from the air the now infamous Lake Pontchartrain for the first time. I remember the drive down the highway to the hotel in (or very close to) the French Quarter. I met Stan Schmidt and his wife there. I met G. David Nordley. I met Poul Anderson and he actually knew who I was. And at a special breakfast, the day of the banquet, I was presented with the AnLab award for best short story of 1992, "Love, Dad."

I did a bit of sightseeing—my first thought at seeing the levy that held out the Mighty Mississippi was that, if that thing ever broke, the city was screwed. Of course, it was levies on the other side of town that broke during Katrina—the city got just as screwed. It hurt to watch the disaster on TV; it was like 9-11 all over again. But we can recover from disasters—we always do.

However, what is particularly detestable from my point of view was the rapidity with which some people decided that what needed to be done first was to blame other people for a natural catastrophe. To some, it was all the President's fault, either for money supposedly not approved (though Congress actually passes funding bills), or for not signing a global warming treaty, or for FEMA not being some kind of a national rescue force.

Among the first to shower blame was the mayor of New Orleans, even though he himself had failed to properly implement his city's own plan to get the people out of town. Maybe you saw the photos—hundreds of neatly parked buses up to their wheel wells in water. The governor of Louisiana was certainly ready to spread blame to the national level, though her management style of consistent dithering during the crisis soon became evident. Even congress-people from states a thousand miles away tossed around blame, as if they were in a position to know.

The press ate all of this up. The reputations of some public officials were destroyed long before anyone could possibly know who did or did not do what—once again, public perceptions formed via panicked reporting.

I only mention this in the context of an article on returning to the Moon because this acrimonious, short-sighted, partisan, self-serving fault-finding *during* a crisis is exactly the kind of knee-jerk, counter-productive, self-absorbed, cover-your-ass, anti-survival, behavioral bullshit up with which we can not afford to put up if we're ever going to go into space to stay.

At a time when *all* of our leaders at *all* levels should have been pulling together, too many were jockeying for personal or political advantage. Returning to space to stay is going to require a *consistent,* long-term, national commitment. Anything short of that will give us more of what we already have—a space station with no clear reason to exist but too expensive to discard; a space shuttle fleet grounded again, riddled with flaws even when it was new because of shortsightedness; and no return to the Moon.

Remember that the next time you vote.

I was nine when we went to the Moon the first time. I'll be almost sixty when we return; if NASA can meet its schedule. I was so excited by the new plan that I even rejoined the National Space Society so I can stay updated.

I really want us to go back, but I'm skeptical that we actually will. I'm going to work for it though. I'm going to try to shape opinions. But it will be tough—we as a nation, or even as a planet, are going to have to learn to put a worthy future goal ahead of perceived immediate needs—again and again and again. For in the end, if we (you, me, our leaders, all of us) can't collectively, or individually, get over ourselves enough so that we can accomplish this worthy goal, then the question of whether or not we can, or should, or must, or might return to the Moon is moot.

We just won't. ■

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STEPHEN BAXTER

After many years of writing Biolog, our occasional feature about our authors, Jay Kay Klein, who created the column, has decided to step aside and turn the job over to someone else. We thank Jay Kay for his many years of service, and we welcome Richard A. Lovett, already very familiar to Analog *readers, in his debut as our resident "Biologger."*

Illo. © Stephen Baxter

Stephen Baxter's critically acclaimed novelette, "PeriAndry's Quest" (*Analog*, June 2004), is set in a world in which time flows faster in the high-elevation "Attic" than at ground level. In the sequel, "Climbing the Blue" (*Analog*, July/Aug 2005), his protagonist takes advantage of this to do a lifetime's work in less than a year.

To U.S. readers, Baxter may appear to be living in his Attic, popping down occasionally to deliver beautifully crafted story gems that seem to come from nowhere. But Baxter's "Attic" is England, where he's been honing his craft for nearly two decades. In that time, he's written 36 books (including three collaborations with Arthur C. Clarke), more than 100 stories, and served as vice-president of the British Science Fiction Association.

Born in Liverpool in 1957, he earned a Ph.D. in aeronautical engineering, taught physics, worked information technology, and took a stab at a cosmonaut slot on the Russian space station *Mir*. He thinks it's critical for NASA and other space agencies to reestablish the sense of wonder by sending poets, philosophers, and science fiction writers into space, but he washed out early and has had to continue that mission via fiction.

His first professional sale was to *Interzone* in 1986, but he didn't reach *Analog*'s pages until July/Aug 1998, with "Moon-Calf," a not-quite alternate history exploring the prospect that with minor social changes, the Chinese could have beaten the Europeans into space.

Two years later, he was back with "Sheena 5" (May 2000), the tale of a genetically modified squid on a space mission to save Earth. Both "Sheena 5" and "Moon-Calf" won AnLab awards. Another unusual viewpoint character appeared in his next *Analog* story (also an AnLab winner), "The Hunters of Pangaea," which featured tool-making dinosaurs as its protagonists. Perhaps it's no surprise that Baxter has also written a trio of young adult novels from the viewpoints of intelligent mammoths. **Continued on p. 142**

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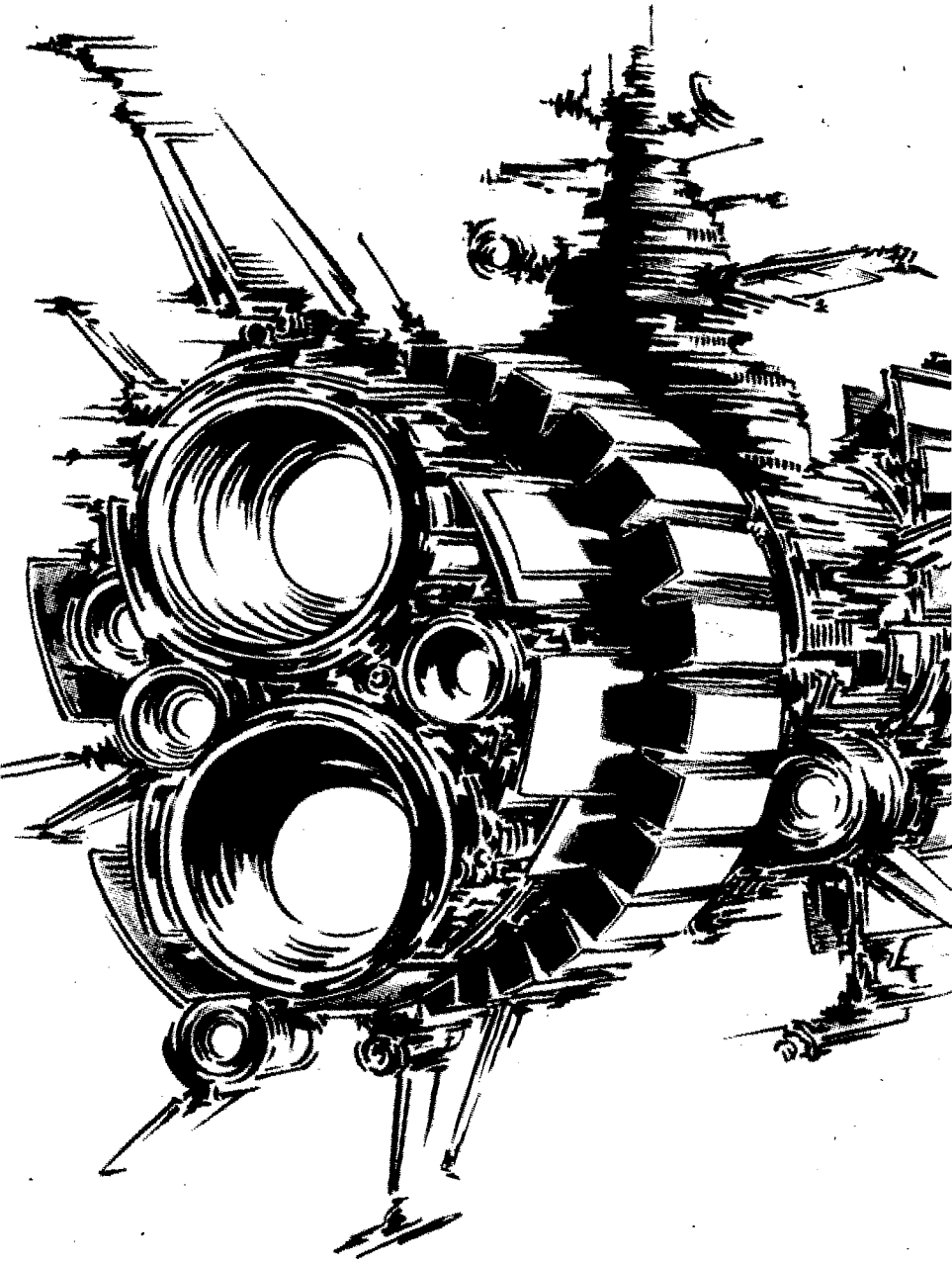
You can't have everything you want, but you can make the best of what you have . . . .



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There's a place, they say, where sailors go when their last voyage ends, when their ships come apart among the drifting reefs of an asteroid belt or vanish in the great dark between the stars that light worlds. A place where the engines never falter and the hull never cracks, where particle storms never rage in sudden fury that pierces shielding to shred the workings of machines and men and leave lifeless wrecks in their wake. A place where every sailor has a safe posting and a fair wage and every Captain sees a decent profit from a hard run. A place where the bars are cheap and honest, the planet-tied greet sailors with open hands and hearts, and every ship finds welcome and a safe berth.

The place is called Haven, they say. No chart shows you the way, no sailing directions offer guidance, no star map carries the name. But when the need is great and the time is right, a true sailor will find it. Or so they say.

"Bunch o' crap," Dingo mumbled around his beer mug as the old drunk at the next table kept talking about the mythical sailor's paradise known as Haven. Dingo drained the last of the brew and banged his now-empty mug on the table. A passing waiter paused just long-enough to slop more beer into the mug, allowing a big head to form, and tapped the counter on his waist racking up Dingo's tab. Dingo grunted with disgust and blew off the foam, squinting at the actual beer level. "They do that on purpose."

"Really?" I pushed a lot of sarcasm into the word so that even Dingo would pick up on it. "When'd you figure that out?"

"Go to hell, First Officer Kilcannon, *sir*," Dingo suggested. "They're cheating us, is what they're doin'."

"And they do the same damn thing in every damn bar in every damn port from here all the way back to Mother Sol."

Dingo drained his beer again, belched, and got another partial "refill" almost as fast. "That's what I mean. That attitude. What makes them think they can get away with that?"

"Experience with dumb sailors."

"Screw you, Kilcannon."

"No, thanks. I've already had that taken care of today."

"Then why're you bein' such a wise-ass? Wasn't it any fun?"

I shrugged. "It was business. Services paid for, services provided."

"Saints, but ain't you in a foul mood. Have another beer." Dingo flopped backward and smiled loosely. "Works every time."

It did for Dingo, anyway. I looked at him, sagging into his battered chair, his eyes glazing over as the alcohol from several earlier beers finally hit his system. Dingo didn't believe in Haven, maybe because he thought he could find it in every bar. As long as his money held out and I got his drunken carcass back to the ship afterwards. "Don't forget we're sailing tomorrow."

"Why do you think I'm getting this drunk?" Dingo stared blearily at his beer mug, as if uncertain whether it still held liquid.

"I'm going to need you functioning tomorrow. We've got three new hands coming onboard."

"Hah! How'd you swing that? Lie about our next port?"

"Yeah."

Dingo began laughing silently, his sides shaking and an enormous grin splitting his face. He bent over, gasping for air. "They'll kill ya when they find out, Kilcannon," he finally managed to stammer. "I swear they'll kill ya."

"I'll worry about that when the time comes."

"You do that." Dingo raised his mug, tipping it vertical to get every drop. It fell back onto the table again, but before the waiter could slosh any more into the mug I slapped his hand aside. "Hey. I ain't done."

"Yes, you are."

"You ain't my mother and you ain't

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the Captain and dammed if I'll let you nursemaid me, Kilcannon! I quit!" Dingo struggled to his feet, his hands clenched into fists. I stayed seated, just looking back at him. "Get up! Damn ya, get up! When I'm done there won't be enough of ya left to run through a recycler."

"Right." I stood slowly, keeping my hands lowered. "Let's go."

"I told you I quit! I ain't goin' on this voyage! I never aimed to and I won't! Not there!"

"Okay."

My answer took a moment to penetrate through layers of alcohol-soaked brain cells, then Dingo lowered his fists a little and stared at me. "Okay?"

"Sure. Let's get your stuff off the ship. You'll need it."

Dingo grinned broadly, wavering on his feet. "Now that's a saintly way to be, Kilcannon. I was wrong about you. Sure I was."

I plopped a credit chip on the table and steered Dingo out of the bar. We wended our way back to the ship, dodging other drunken sailors as we went. Every once in a while, the orbital port's gravity would stutter a little in our area, making me waver on my feet as badly as Dingo for a moment. That's one of the hazards of being in the low-rent areas of any port off-planet. Outside every bar in the area near the port were other hazards, men and women who looked young and cheap and pretty in the dim lighting, beckoning and calling invitations to visit the particular establishments where they got kick-backs for luring in customers. I fended off all of them.

Our IDs got us onto the pier and onto the ship. Dingo paused outside his quarters, swaying on his feet as if our ship was riding on a planetary ocean. "Ya sure this is okay, Kilcannon?"

"Yeah. No problem."

"I'm gonna get my kit."

"You do that." I gestured him inside. Dingo grinned and staggered into his quarters. I waited until he was almost to the bunk, then keyed in the security override on the hatch. Dingo was still turning his head to see what the noise was when the hatch slid shut and locked. I heard a roar of anger, followed a second later by the impact of Dingo's body against the hatch. Silence followed, so apparently Dingo had knocked himself out. Hopefully he wasn't hurt too badly. I had no intention of cracking that hatch before the ship was safely underway tomorrow. "See you in the morning, Third Officer Dingo."

I walked down the passageway, easily seeing dark patches of mold on the overhead even in the dimmed night lighting of the ship. The *Lady Be Good* badly needed a full-scale fumigation, but that was just one of the things she badly needed that she wasn't going to get any time soon.

The port inspector arrived half an hour late to give us departure clearance. As far as I knew, Dingo still hadn't awoken and started demanding his freedom, and none of the three new sailors had shown any signs they suspected our destination wasn't the same one they'd signed on for. The inspector gave the entry lock of the *Lady* a sour look, but she couldn't flunk us on the basis of that lock. I kept that working even if it wasn't pretty.

The inspector ran down the checklist. "You claim you've signed on enough new sailors to meet minimum crew requirements."

"That's right." You couldn't be too subservient or the public servants would ride right over you, but you couldn't dis 'em either. Not if you were smart. "You can confirm they're onboard from the pier access records."

"There's ways to gimmick those records."

"I wouldn't know anything about that."

"I bet you don't." She picked a name at random. "I want to see Able Spacer Kanidu. In person. Here."

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"Okay." Odds had favored her picking one of the new hires, but I'd still worried she might ask to see Dingo. Dingo would come around once we were underway. He always did after any little misunderstandings while he was drunk. But right now he'd still be a bit upset with me.

Kanidu answered the hail quick enough. Short and stout, she gave the inspector a bland look and confirmed all of her qualification data. Finally satisfied, the inspector let the sailor go. "I need to verify your cargo manifest."

"Sure." I let her plug into the ship systems and check the cargo containers. A really good inspector would've suited up and crawled over the big cargo containers fastened around *Lady*'s core, even opening the loading doors to check that the contents matched the manifests. But really good inspectors didn't work the early morning weekend shifts and didn't bother with small freighters like *Lady*, so it'd been safe to assume we'd just get a manifest check.

I'd been assured the inspector wouldn't be able to spot that the manifests had been falsified. I mentally crossed my fingers and hoped the assurances were accurate.

Apparently they were. The inspector moved on to more items on the checklist, mostly dealing with equipment. "It's been a long time since your last engine certification."

"We're within limits."

"Time-wise, maybe." She gave the entry lock another look. "How well does your gear still work?"

It wouldn't take a lot of experience for her to guess our gear wouldn't pass a certification test right now. "It works fine."

"Maybe I ought to look at it."

Maybe. I knew what that meant. "Hey, I just remembered something. Can you hold here just a sec?"

She gave her watch an annoyed look and nodded. I went straight to my quarters. In the bottom of one drawer, well wrapped, I found the bottle and carefully carried it out. "I've got a friend in port I meant to give this. But I forgot. Could you get it to him?"

"I suppose." She took the bribe, examining the label as if ready to reject it, but then her face cleared. "From Mother Sol?"

"Yeah." Mother Sol was a long, long ways from the port of Mandalay orbiting the planet of the same name orbiting the star humans had named Ganesha. Anything from Sol, even rotgut, had the exotic aura imbued by great distance, and this wasn't rotgut. "From Martinique. That's an island. It's good rum. You ought to try some."

"Maybe I will. I guess this friend isn't that special if this is all you got him."

I shrugged and gestured at the entry lock. "Funds are pretty short right now. It's all I could afford."

"Okay." Cover story for the bribe established for the benefit of any hidden recorders, and her questioning whether we could give her a bigger payoff also fielded, the inspector pocketed the bottle. "You're cleared for departure. But I've tagged your ship entry. Next time you hit this port you'd better have a recent engine certification or we'll do a full inspection."

"No problem."

She grinned at what we both knew was a lie, then headed off, patting the place where she'd stashed that rum. Damn. I'd been saving it for a special occasion. But like just about everything else, I'd had to use it in an emergency.

I checked the lock's log to confirm everyone was aboard, then sealed the lock tight. "Able Spacers Kanidu, Jungo, and Siri. Meet me in the crew's mess."

The two tables grandly labeled the crew's mess had plenty of empty places even when breakfast was supposedly being handed out. Dingo wasn't here, of course, but we had a lot of unfilled slots. We couldn't afford to pay for a full crew, but then again that wasn't really a problem because it was so hard to get sailors

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to sign on to a ship in *Lady's* shape that recruiting just enough to meet minimum standards was a big enough challenge.

Kanidu eyed me in a disinterested way as I assigned her to engineering and pointed her toward Chief Engineer Vox at one of the tables. Vox just nodded silently when Kanidu reported to her.

Jungo was a tall, slim guy with an eager smile who'd been happy to sign on. I wondered what he was hiding and who or what he was running from. I gave him to the cargo section.

Last came Siri. She was a small woman, thin and shivering slightly, carrying every indication of being a star dust addict. No wonder no other ship had taken her on. She'd go cold turkey for certain on our voyage, which wouldn't be pretty, but the worst that could happen was she'd die and then we wouldn't have to pay her. I gave her to ship's systems, because she'd been certified a System Tech Second Rate at one point. Maybe her dust-addled brain still remembered some of that.

I stopped next to the Chief Engineer. "We okay to go?"

Vox nodded wordlessly again.

"Anything I need to tell the Captain?"

Vox dug something out from between her teeth before answering. "Refit."

"I know we need a refit. As soon as I can—"

"Shipyard."

I stopped talking and just nodded back. The *Lady* needed a full engineering refit in a shipyard, nothing less. The Chief Engineer had a responsibility to remind me of that. I couldn't do a thing about it, but I had to be reminded of it.

I went forward, trying to figure out where I might be able to get the *Lady*'s engines looked at for something less than cut-rate prices. Maybe an underused maintenance facility at a middle-of-nowhere star would be willing to give us a break for the sake of keeping their hands in. It was worth a try.

Captain Jane Weskind sat in her still-darkened cabin. She'd gotten dressed by herself but didn't look good this morning. "We're cleared to leave," I reported, standing in front of her desk and touching my brow with my right hand.

A long moment passed. Weskind's face cycled through a half-dozen emotions before she caught it and froze it in a shaky grin. "No problems?" It was what she always said, now.

There wasn't a thing she could do about engineering and she'd already been told we were overdue for a yard period. "No problems."

"Good work, First Officer Kilcannon." She lowered her voice, as if sharing a secret. "The *Lady* needs work. I know it." A long pause. "A good profit on this run. That's all we need. One good run." Another pause. "Right, Kilcannon?"

"Right, Captain." She always said that, too. Just one good run. That wouldn't be enough, of course, but with the profit from one good run we could set up an even better run and then we'd be on our way up again. Dingo might think Haven was in the nearest bar, but Captain Weskind clung to it being one good run away. It seemed it had always been one good run away and maybe it always would be one good run away. Maybe not, though. This run did promise a good return. Not without risk, of course. I smiled and nodded at Captain Weskind's words because this really could be the one good run we needed, and because I was sure Captain Weskind needed to believe that run would happen and needed to know I believed it, too. "Will you be on the bridge when we leave port, Captain?"

More expressions chased their way across Captain Weskind's face. "I . . . have work, First Officer Kilcannon."

"I understand, Captain. I'll take the ship out."

"Thank you, First Officer Kilcannon."

I saluted again and left, making sure her hatch was set to notify me if Captain Weskind left her cabin. It didn't happen much nowadays, but I needed to be there if she needed me.

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Leaving port was the usual mix of tension and boredom. Tension because things could go wrong. A blown directional vector or an aging control system sending the wrong commands could result in a painful meeting of ship and some other object. *Lady* wasn't the smallest freighter running between stars, but she wasn't all that big, either. Odds were if we hit anything *Lady* would be the loser.

But it was boring, too, because the procedures were ones we'd run through a hundred times and they didn't change all that much from port to port. Same old drill, often in different places, but always the same old drill.

Then we were out of the confines of the port and running free down the outbound shipping lanes, heading outward past planets and rocks and comets, aiming to get far enough from the gravity well of Mandalay's sun, Ganesha, to start our jump. Systems, especially inner systems, always felt cramped and crowded when you were used to the wide open freedom of the big dark. Nearly a hundred suns held human colonies now, and even after so many years of sailing between them I still felt a moment of wonder at the thought that the *Lady* could carry me to any sun and planet I chose. In theory. In practice, we could only go where the paying cargo runs took us. The roads between the stars aren't free, no matter what the poets dream far away on Mother Sol.

Here, close to port, the inbound lanes passed near the outbound. I watched the big ships coming in. Sol Transport, Vestral Shipping, Combined Systems, Great Spinward. The ships belonging to the giant companies seemed to glow on our screens, all their systems registering in top shape on our readouts. I fought down a wave of envious anger. With a fraction of what the big companies spent to keep those ships of theirs shiny I could get *Lady* back in shape. But it wouldn't happen. *Lady* was beneath their attention. The ports *Lady* called at were often beneath their attention. The cargo *Lady* carried usually wasn't worth it for the big carriers. So I watched the big ships pass and wished for more of their leavings.

Maybe some of them were watching old, small, battered *Lady* heading out. If they were watching, I could too easily imagine what they were thinking. I wished the wrath of the saints on smug company spacers and went to let Dingo out of his quarters.

I double-checked the jump solution while Dingo glared at me. The lump visible on his forehead hadn't aided his forgiving me for tricking him last night. But he'd done his job right. A short run to Wayfare, then a middling run to a nowhere star named Carnavon that didn't see much traffic and wouldn't have any local authorities asking awkward questions, and finally a long run into Fagin. The circuitous route should bring us into Fagin along routes a fair ways from the usual inbound and outbound channels for that system. "Looks good."

"As if I didn't know this job better'n you, Kilcannon!"

"Dingo, somebody has to double-check things like this. You know that, too."

"Oh, I know lots, Kilcannon. Did you tell them new ones yet where we're goin'?"

"No." Jungo, nearby, looked over with ill-conceal alarm.

Dingo grinned nastily. "Where d'they *think* we're goin'?"

I didn't answer, so Dingo looked at Jungo, who swallowed nervously. "Polder," he half-whispered.

"Polder! Hah! Try Fagin, lad."

"Fagin?" Jungo paled. "But . . . the war."

"Yeah! Civil war! Brother against brother! The best kind. And the best rates for those willing to try to run cargo in through the privateers roamin' the spaceways."

The crew would've heard sooner or

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later, but I still wasn't happy having it spilled now, days before we'd get far enough out-system to enter jump to Wayfare. "Shut up."

Dingo just grinned at me. "'Shut up,' is it? And what'll you do if I don't, Kilcannon? Shanghai me on a voyage to a war zone in an old tub that should've seen the wrecker's yard a handful of years ago?"

Jungo was shaking his head. "I signed on for Polder." His voice wavered. "My contract says Polder."

I shook my own head. "Your contract contains a necessity clause which allows the ship to change destinations if required. You ought to be grateful for that. We won't meet any arrest warrants on any of our crew that've been forwarded to Polder. Right?"

Dingo laughed again, Jungo looked stricken and relieved at the same time, and I ignored both of them.

So many ships. I keyed the transmitter again. "Wayfare System Control, this is *Lady Be Good* still awaiting authorization to clear system."

I sat back to wait. Spacer Siri was at the auxiliary control panel on the bridge, shivering constantly, her eyes going into and out of focus. Withdrawal from star dust wasn't pleasant to watch, but watching was all anyone on the *Lady* could do. It'd either kill her or leave her clear. So far, Siri had been able to follow orders when I snapped them at her.

A babble of messages from other ships to Wayfare System Control and each other flowed in after I stopped transmitting. The authorities at Wayfare were obviously overwhelmed again. Why one of the most often used relay stars couldn't upgrade its system control was beyond me.

Lady was skating along the fringes of Wayfare, just heading for the jump point to Carnavon. A slightly unusual route, but I knew from experience that Wayfare System Control would be too busy to worry about what one little freighter was up to.

And I was right. "*Lady Be Good*, authorization granted to clear Wayfare." I punched in the jump commands, secure in the knowledge nobody was paying attention to *Lady*.

Nearby, Spacer Siri shivered. I dug a packet out of one of my pockets and tossed it to her. "These'll help." She caught the packet automatically and stared at it. "Somebody I knew beat star dust. They said that stuff helped a lot."

Siri nodded, tearing open the packet with trembling hands. I went back to studying my control panel. Somewhere aft, one of the engines groaned into momentary instability that made my stomach flutter. A moment later, Chief Engineer Vox called the bridge. "Bad."

"Can you hold it together?"

"Yeah."

"How long?"

"Depends."

"Give me as much warning as you can."

"Just did."

Carnavon was small and dim. For a star, that is. No other ship beacons flared on our scans. Quiet and isolated, just the place for a small ship looking to avoid awkward questions.

To get the right arrival angle on Fagin we'd have to fall through the Carnavon system and climb out the other side, a time-consuming pain in the neck under any circumstances.

"Hey, Kilcannon."

"What, Dingo?"

"On the bridge, sweetheart."

I made my way up there, wondering what Dingo could have to talk about that needed me on the bridge in person. Most of the possibilities weren't very good. But Dingo didn't seem worried as he pointed at the scan. "What d'ya think that is, Kilcannon?"

I peered at it, checked readings, then thought about it. "What do you think it is?"

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"I asked first." Dingo smiled with derision. "Don't know, d'ya? How long ya been a sailor, Kilcannon?"

"Long enough." I frowned at the scan. "It looks like a dead ship."

"Not bad! It's a ship, alright." Dingo's smile vanished. "She ain't dead. Not yet." He tapped a blunt nail on some of the readouts. "It's real faint, but there's still a heat source active in there, and leaking atmosphere."

"Saints. Are you saying there's someone still alive on that thing?"

"Could be."

A wreck would've been interesting as a possible source of parts, though probably not interesting enough to warrant a diversion from our course. Wrecks tended to be stripped before we ever saw them. But if some of the crew had holed up in the interior . . . "There's no distress beacon."

"Nah. Which tells you and me how that wreck got in trouble, right?" I immediately checked scan again, but Dingo was already grinning at me. "I checked. As good as I could with this tub's instruments. There ain't no other ships burning engines in this system right now. Either the pirates or privateers are sitting quiet in ambush, or they've left."

I scowled at the display. "Getting to that wreck will take us way off our track."

"Yeah."

"If somebody was waiting to ambush any rescuers, they'd have left the distress beacon working to lure people in, wouldn't they?"

"Yeah."

"But anybody still onboard it is most likely already dead."

"Yeah."

"But if anyone finds out we disregarded a ship in distress they'll take the *Lady* and our licenses."

"Yeah. But if any survivors die they won't be telling on us, will they?"

"Damn you, Dingo. Get us over to that thing." I turned away. "I'll brief the Captain."

"Yeah. You do that."

It was a big one. Once *Lady* got close enough we could read the registry. *Canopus Rising*, one of the Vestral Company's ships. But she wasn't bright and pretty anymore. Somebody had kicked *Canopus Rising* in the butt and kept kicking.

"Engines slagged," Chief Engineer Vox grunted, pointing to the image. Somebody had hit that part of the *Canopus* with heavy artillery while the engines were running, adding the suddenly unleashed power of the ship's own engines to the destruction the weapon wrought.

I exhaled as a slim hope vanished. "What're the chances any parts in those engineering areas are salvageable?"

"Zilch."

I brought us as close as I could. We were still picking up faint leakage of heat and gases, so whatever survival space the crew must have rigged up still existed. Whether there was anyone left alive in it was another matter. "Dingo, take the lifeboat over. Take three sailors along to help."

"You're not going yourself?"

I gave Dingo a level stare. "I have to stay with the ship. And keep the Captain informed."

"Ah, yes, so you do. Can you walk with me to the lifeboat?" I went along, knowing Dingo wanted to say something where we couldn't be overheard. "Kilcannon, there's a chance they're still alive, and if they're still alive, there's a chance they're in bad shape, and if they're in bad shape then there ain't much you or I can do for them."

I pretended to study the readouts on the lifeboat access. "And?"

"Do we haul 'em here and wake 'em up enough to know they're hurting so they can die?"

I took a deep breath, thinking. "Yes."

Dingo shrugged. "You're the boss."

"Dingo, it's up to the saints whether

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or not they die. I won't make that decision for them."

Another grin. "The saints don't like to be crossed, do they? Ah, here's my crew. Strap in."

I reported to Captain Weskind, then went back to the bridge and watched the lifeboat match velocity, roll and tumble to the wreck. Whatever his limitations as a man of culture, Dingo was a sailor's sailor who knew how to drive even a lumbering lifeboat.

I'd learned patience on many long watches between the stars, and I needed it now. I knew Dingo and his crew were working their way inside the wrecked ship, but *Lady* couldn't afford fancy communications and tracking gear. All I could do was watch the lifeboat where it rested on the hull of the *Canopus* and wait.

It took an hour. "Ahoy on the *Lady*, this is Third Officer Dingo."

"This is Kilcannon."

"We got 'em. Six souls. They're all walkin'."

Six sailors. Maybe Vestral would cough up a reward. "Anything we can use onboard?"

"Nah. The bastards who done 'er in stripped 'er good. All we're gettin' out of this one is happy points with the saints."

"Most likely." Perhaps ten more minutes passed, then the lifeboat detached from the wreck and made its slow way back.

I was at the access when they arrived. Curiosity aside, protocol demanded it and I wasn't going to let any company sailors say the *Lady* hadn't done things right.

Two officers, three able spacers, and one woman who wasn't wearing a crew coverall. The senior officer extended his hand to me. "First Officer Chen. We'd about given up hope."

I shook his hand and smiled politely. "I'm glad we were able to help." Behind Chen, the junior company spacers were gaping around in obvious dismay at the condition of the *Lady*. The other officer and the woman showed better manners.

Chen gestured to his companion. "Third Officer Constantine." Constantine nodded her head, giving me a grateful smile.

Then Chen pointed to the woman who wasn't dressed like crew, but before he could speak she came forward. "Halley Keracides. Thank you, Captain."

I shook my head. "I'm First Officer Kilcannon. Captain Weskind couldn't be here. She sends her apologies. What happened to you all?"

Chen grimaced. "When we came out of jump here in Carnavon there was a pirate right on top of us." Dingo frowned in disbelief. I imagine I did, too. "I know the odds against that. But it turned out our Fourth Officer had sold our jump calculations. Perfect place to betray us, a system where the odds of anyone stumbling across the attack would be almost zero."

"I take it that's why the Fourth Officer's not with you."

Another grimace. "Him because he sold us out, and most of the others for ransom from Vestral. But the pirates didn't have enough space for all of us, they said, so they left us six behind. Me and Constantine with the sailors because they said we had bad attitudes."

I imagined the Captain of the *Canopus* had displayed plenty of bad attitude as well, but they would've needed him or her for any ransom demand. I looked at Halley Keracides. Neither she nor her clothes bore signs of anything beyond a middle-class income. "I guess they didn't think Vestral would cough up any money for you."

She gave me a flat look back. "Why would they?"

Then again, maybe she'd had a bad attitude, too. I faced First Officer Chen. "Our crew's not at full strength so we've got some spare accommodations. You can have our Second Officer's quarters."

Chen nodded politely, keeping to himself whatever thoughts he might have about a ship that was sailing with-

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out a Second Officer onboard. "Thank you for the offer, but I feel Ms. Keracides should have those quarters."

It didn't matter to me. "Fine. Dingo, show everyone to their quarters."

"I got a lifeboat to stow, darlin'." I counted to five slowly, letting Dingo see how I felt. He shrugged. "Fine. I'll do it later. Come on, you."

Chen must have talked to his sailors, because the next time I saw them they were pretending not to notice what bad shape the *Lady* was in. Chen offered on behalf of all the sailors to work for their room and board until I could drop them off in port, which offer I cheerfully accepted. I could use skilled sailors, especially ones I didn't have to pay. "What about Ms. Keracides? What's she do?"

Chen dropped his eyes and shrugged. "She's a manager of some sort, I understand."

"Then she doesn't do much."

This time, Chen grinned. "Probably not. Uh, I don't want to imply anything, but I do know something about engineering . . ."

"Our system's badly in need of overhaul. I know."

"I might be able to help. I asked your Chief Engineer about it, but she didn't say anything."

"She usually doesn't," I advised Chen. "Just show up and do whatever you can."

I was on the bridge, picking at my lunch, when Halley Keracides came up. She peered around. It wasn't the blank surface examination of someone out of their depth, though. She apparently knew something about ships. "Mind if I sit down?" she asked.

I indicated the observer's chair. "Feel free."

She twisted the chair, giving me an arch look as it protested swiveling. "I wanted to thank you again. It was getting very bad in the survival compartment the crew had rigged up. I was getting ready to greet the saints."

I nodded. "You're welcome."

"Where are we going?"

I'd been waiting for that question, but I guess Chen had been hesitant to ask. I balanced truth and falsehood for a moment in my mind and decided the truth didn't matter at this point. "Fagin."

"Fagin?" she questioned. Then she repeated it, her voice sharper. "*Fagin*?"

"Yeah, Fagin."

"That's a war zone."

"That's why we're getting paid well to run this cargo in."

She watched me for a moment. "Why are you going to Fagin through Carnavon?"

So Ms. Keracides really did know something about ships. Or about the routes ships took between stars, anyway. "We needed a different approach path in-system." I couldn't tell how much she understood what that implied.

Her eyes narrowed. "You'll be out of normal transit lanes."

She understood a lot. "We want to avoid privateers. All three sides in the civil war have issued letters of marque."

"You'll also be avoiding peacekeepers, won't you?"

She understood entirely too much. "It's a calculated risk. Perhaps you're unaware of the realities of operating for a ship like the *Lady*. We don't have company contacts and company contracts. We get by on what the big companies don't want to bother with. That means we end up taking chances."

"There's nothing dishonorable about working a smaller ship," she stated, answering the thing I hadn't said.

"No, Ms. Keracides, there isn't. I'm sorry we're taking you into Fagin. But once we drop off our cargo we'll be able to get you to a peacekeeper station. Vestral ships help supply those, right? So you'll be okay. It'd only take a few more weeks to pass through Carnavon, then a little while in jump."

"We appreciate the service, First Officer Kilcannon," she stated dryly.

After Halley Keracides had left, I won-

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dered for a moment why she'd lumped herself in with the Vestral employees with that 'we.'

A week later to the day, Halley Keracides was leaning against the entry to my quarters, her arms crossed over her chest. "I just learned a funny thing."

I sighed and leaned back to look at her. "What's that?"

"First Officer Chen saw a part in your engine room that looked a lot like something Vestral uses. Proprietary design. It'd been modified to fit your system."

I pretended to think about that. "So?"

"Vestral doesn't sell those parts. Where'd you get it?"

"A bulk salvage supplier. He gave us a clean bill on it."

"Uh-huh. What'd he charge?"

I let annoyance show. "I'd have to look that up."

"Don't bother. I bet it was fairly cheap, right?"

I stared down at my desk. "We could afford it. The supplier gave us a clean bill."

"Kilcannon, I'm not an idiot and neither are you. That part was obviously stolen property."

I looked back at her, keeping my expression controlled. "The supplier gave us a clean bill," I repeated.

"And you expect me to believe that you never suspected the part was stolen."

"I'm not a cop and I don't have the time or money to do the cops' jobs for them."

"An ethical sailor wouldn't do that kind of business," she shot back.

"Some kinds of ethics are luxuries, Ms. Keracides. We can't afford a lot of luxuries on the *Lady*."

Her face closed down and she started to spin away, then stopped herself and eyed me. "'*Some* kinds of ethics are luxuries,' you said. Just some kinds?"

"Other kinds are necessities. I haven't forgotten that." I rubbed my lower face with one hand, looking away from her again. "I believe I'm still an honest person, Ms. Keracides. And I know the *Lady* is still an honest ship. Captain Weskind wouldn't have it any other way."

"I'll have to take your word for that, since I've yet to meet her."

"I'll try to set up a meeting."

"Thank you." She was silent for a long time, and when I finally looked back at my entry I saw she'd gone.

Two days shy of jump I felt the shock of something, then the *Lady* shuddered and bucked. I was halfway to the bridge before the motion damped out. One scan of the instruments told me where the problem was. "Engineering? Are you okay down there?"

"Yeah."

"What the hell was that?"

Chen came on. "The primary waste heat vent has blown."

I dug my knuckles into my head, trying to think. The engines couldn't run long with the primary vent out. If we didn't get it fixed soon the engines would overheat. Then we either let them blow or shut them down, in which case the radiation shields would drop and the high-energy particles being hurled out by Carnavon would fry us in short order. Unlike the *Canopus*, the *Lady* didn't have a radiation-shielded citadel where we could hide for a while. "How long to fix?"

"You tell me. That's an external job. What shape is your external repair 'bot in?"

I almost laughed at the question. "External repair 'bots are for company ships. Ships like the *Lady* can't afford that stuff."

Chen took a moment to answer. "You'll need to send a sailor out. It's hazardous, but there's no alternative"

"Yeah."

"He or she has to know the equipment and how to replace the vent and be qualified for external repairs underway. I'm afraid my own sailors don't know your layout well enough."

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"I wasn't going to volunteer them." Maybe my reply had come out harsh. Chen didn't talk again for a while. "There's a couple of people on *Lady* who can do it." Yeah. Two of us.

Fifteen minutes later, Dingo checked the last seals on his suit and gave me a lop-sided grin. "Gonna make me earn my pay this time out, eh?"

I tried to smile back. "You know how to do this, Dingo. Better than anyone else on the ship. I talked to the Captain and we agreed you were the only one who could do it."

"Yeah. Sure. You're gonna keep them engines goin' while I'm out there, ain't ya?"

"We don't have any choice."

"Gonna be no fun, Kilcannon. Not hangin' on the outside while the engines are goin' and me wrestling with that duct."

I nodded. "I swear, Dingo, I'd go if I could."

"If something happens to me before I finish the job you'll *have* to go. And good luck trying to finish it yourself. You're not half the outer hull rider that I am. Not half the sailor, neither, though you'll never admit it. Tell you what, Kilcannon, when we hit the next port you pay for the beers. And no bitchin' from you on account I'll be drinkin' the good stuff. Deal?"

"Deal."

"And if worst comes to worst, you put in a good word with the saints for me."

"I'll do that."

I watched the lock mechanism cycle, not knowing what else I could do, while Dingo exited the lock and headed aft along the outer hull. At some point I realized Halley Keracides had come up to stand nearby. "I understand the primary waste heat vent blew," she stated softly.

"Yeah."

"I've never heard of that happening."

I gave her an icy stare. "Not on a Vestral ship, I'm sure. But if you go long enough between engine overhauls it can happen."

"Saints, Kilcannon, it takes more than a missed overhaul to lose a primary waste heat vent."

She was right, which made me wonder again just what kind of 'manager' Halley Keracides really was. "The part was reworked. We got it quite a while back."

Her voice stayed soft. "That's one hell of a way to keep a ship running, Kilcannon."

"It's the only way I've got."

Instead of answering she just stared at the airlock controls along with me. In my mind, I traced the path Dingo would be taking, out the airlock and crawling up over the last row of cargo containers strapped around *Lady* like a huge belt. The containers that came carrying our cargo tended to be old and poorly maintained, so handholds were often loose or missing entirely. After getting over that obstacle, he'd have to work his way back down onto *Lady*'s hull to where the vents lay not far from the stern. Even in dock the trip could be a pain in the neck. Out here it'd be, as Dingo had said, no fun at all.

Given that, I wasn't surprised it took another couple of minutes before Dingo called in. "Hey, on the *Lady*. You there, Kilcannon?"

"I'm here. How's it look?"

"Like hell's own mess."

"Can you fix it?"

"If I can't, no one can."

As the minutes crawled by I tried not to think about Dingo out there on the hull, the energies of the engines thundering not far from him. Even the tightest grip on a hull felt too light when your ship was running through the dark. But Dingo would have to anchor himself using tethers and employ both hands to replace the failed sections of the vent, wrestling with warped metal in the dark and the cold, wearing a suit I knew was too old and too worn. "Dingo."

"Waddaya want?" Dingo sounded out of breath. Tired.

"Maybe I should swap out with you."

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"Hell, no. It's almost done."

I checked with engineering. "We've got thirty minutes until shutoff will be required. That's plenty of time for you to get in here and rest and me to take care of what's left to do."

"Not your bloody damned job, Kilcannon! Shut up and let me work. It's almost done."

Halley gave me a questioning look and I shrugged. I couldn't go out and drag him back. We waited.

"Almost." Dingo's voice sounded ragged now.

"Kilcannon, this is Chen in engineering. We're getting a heat spike."

Whichever saint had been watching us had just looked away. "Dingo, drop it and get inside. Now. We've got a heat spike."

"I drop it now and we'll lose it."

"That's an order, Third Officer Dingo."

"Didn't hear it."

"Kilcannon, this is Chen. We have to vent that spike. We're holding down the overrides, but the safeties won't let us do that much longer. If the heat spike vents through the secondary it may blow."

"Dingo, damn you—"

"Got it!"

"The safeties overrode our commands! They're dumping the spike!"

"Dingo!" *Lady* shuddered again. I waited a long moment. "Dingo. Third Officer Dingo. Respond." Halley Keracides had her eyes hidden behind one hand. "Third Officer Dingo. Respond." I grabbed the other suit and started getting into it. "Dingo. By all the saints, Dingo . . ."

I'd never realized how slowly the airlock cycled. I couldn't feel anything, including fear, but out of force of habit I made my way cautiously over the battered cargo containers and along the hull as I moved toward the vent. I found Dingo still tethered there. The emergency vent through the secondary had blown away part of its shield, and some of those parts had gone through Dingo's suit and Dingo on their way to forever.

I checked the work on the vent. Dingo had done a good job. Better than I could've done. Then I untethered all that remained of my Third Officer and towed him back to the airlock.

There was a group waiting at the airlock. Dingo had never been a particularly good-looking man. Explosive decompression hadn't improved things any. "Let's get him into the burial capsule." I'd kept one. I could've hocked it, like I had the others, but was afraid if I got rid of the last one I'd suddenly need it. Now I needed it anyway.

The other sailors wrestled Dingo's body into the capsule. "Drop it into the cold storage bin. We'll hold a service later and send it toward Carnavon." I watched them carry the capsule away, wondering what I'd say at the service.

Halley stood watching me. "Did he have any friends?"

"Who? Dingo? No."

"You're sure? Nobody he went ashore with?"

I managed a short, sharp bark of laughter. "I'm the only one who ever went ashore with Dingo."

"Really?"

"Yeah." I rubbed my forehead, trying to push away the pain there. "Dingo was a drunk, and he'd usually get mean."

"Why'd you go with him, then?"

"Somebody had to. Somebody had to make sure he was okay and get him back to the ship."

"You could've told someone else to do it."

I frowned and shook my head. "No. I couldn't trust anyone else not to ditch Dingo when he started getting mean drunk. And it was just easier for me to keep an eye on him." I looked up and saw Halley still watching me. "What?"

"I was just thinking that Dingo did have one friend. And I think he knew it, too."

I shrugged. "And I was just thinking that I wish I'd checked Dingo's suit be-

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fore we sealed that capsule to see if it could be repaired."

I don't know what kind of reaction I was expecting from her, but Halley Keracides just shook her head. "You're a damned liar, Kilcannon." Then she walked away and left me standing there alone at the airlock.

We made it the next two days without further problems. Before *Lady* jumped for Fagin, I held a brief service for Dingo, going over the standard burial-in-space service and saying some things that were true, like he'd been one hell of a sailor, and some things that weren't so true, like he'd also been one hell of a human being. But the saints expected praise when we sent them a new spirit and Dingo deserved whatever boost I could give him.

The burial capsule dropped back toward Carnavon as we accelerated to jump. In time, Dingo's body would be cremated in the fires of that sun. There are worse grave markers.

It'd be a long run to Fagin, with nothing to do but hope nothing else really important broke. I briefed Captain Weskind again. She told me we just needed one good run. I agreed. It looked like we might finally be getting that first good run.

I took Dingo's watches on the bridge. The other qualified watchstanders were stretched thin enough as it was.

That's where I was one ship's night when Halley Keracides came to see me. "I thought you could use some company."

I let my skepticism show. "That's the only reason you're here in the middle of the night?"

"No." She sat down and stared at the displays for a long time. In jump space, they're mostly blank. Whatever's out there doesn't register. There'd been a time when I'd whiled away boring night watches thinking about what I'd do if something ever did show up on the displays while we were in jump. But nothing ever did, and there were a lot more likely to happen things to spend my time worrying about, and after a while I stopped thinking about it. Halley finally looked back at me. "We need to talk. About what happened to Third Officer Dingo."

I nodded, trying not to look angry or defensive. "Talking won't make it not have happened."

"Kilcannon, you know as well as I do that running a ship with systems this old and in need of repair is just asking for more accidents like the one that killed Dingo."

I kept my voice level, somehow. "It's been a real long time since anyone died on the *Lady*."

"I know. I checked. And, frankly, given the shape this ship is in that means you've been doing an incredible job." Halley paused while I tried to absorb what seemed to be an unexpected compliment. "But no human can beat the odds forever. Not when the odds keep getting longer. Skill and hard work and determination can keep a ship going for a long time even when she's only held together by spit and prayers, but sooner or later the saints get tired of staving off disaster and let the worst happen."

I waited to see if she'd say more but she seemed to waiting for me. "What do you suggest I do? This run should pay out well. Well enough to springboard us for an even better run. That'll pay for a refit. Not a great one, but good enough."

Halley leaned forward, searching my face for something. "Kilcannon, a ship's only got so much life in her. *Lady*'s old. You can't make her new again for any sum of money you're ever going to see running cargos on the fringes."

"She doesn't need to be new again."

"Okay, you can't make her *safe* again. Not really. Not for any sum of money you have any realistic chance of generating on cargo runs."

"One good run. That's all we really need."

"Do you really believe that, or are you

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trying to believe that?"

I ignored her question. "Then we'll fix *Lady* up and she'll keep taking care of us. That's what Captain Weskind always says. Take care of the ship and the ship will take care of you."

"Captain Weskind." Halley shook her head. "As far as I've been able to determine, she hasn't left her cabin since I came aboard."

"She's busy."

"Does she really know what shape the ship is in?"

I hesitated and I could tell Halley Keracides noticed. "She's been briefed. I brief her daily."

"I see." I couldn't tell from her tone of voice just what Halley Keracides saw. "Does she know her entire crew could die at any moment?"

"That's not true."

"Yes, it is, and you know it. Those engines are running on borrowed time, Kilcannon. This whole ship is. Sooner or later the engines will fail and you'll never come out of jump."

I pretended nonchalance and shrugged. "I hear Haven's pretty this time of year."

"Haven?" She obviously knew about Haven, the sailor's paradise, which wasn't something you could say about a lot of managers. "Is that where you believe ships go when they don't come out of jump?"

"They've got to go somewhere."

"No, they don't. Not according to the physics. And even if they did, they couldn't go to Haven because there's no such place."

I made another shrug even though I could tell they were annoying her. "It's a big universe."

"Not that big. One single place where every sailor would be happy? No such place could be real." Halley slammed her palm down onto the arm of her chair. "Dammit, Kilcannon, I can't believe this. Why won't the Captain talk to me? I've never seen her and none of the crew will talk to me about her."

"I told you. She's busy. You know a ship Captain's responsibilities."

"I know they allow a few minutes a day to leave her cabin and talk to people her ship has rescued." She fixed me with a demanding look. "The truth, Kilcannon. In the saints' names, what's wrong with Captain Weskind?"

"She's . . ." I looked away but something made me tell the truth for the first time in a long time. "Multipolar degenerative cognitive disorder."

When I looked back, Halley's jaw had actually dropped in amazement. "Untreated?"

"Yes. No. I mean, we haven't been able to keep the right meds in stock." It wasn't something I got to talk about and now the words tumbled out of me. "The right meds could help her even now, maybe. I don't know. Probably not. But the right meds cost money. A lot of money. So did doctors authorized to prescribe them. Weskind spent the money on the *Lady*, instead. It wasn't enough, but it was more. That's what she said every time I suggested keeping her body on an even keel, and even I couldn't explain how she'd get refills for special meds in some of the ports we hit."

"By the saints, Kilcannon, someone with untreated multipolar can't run a ship!"

"*Captain Weskind can.*"

She sat back, eyeing me with an expression I couldn't read. "You do realize you have a legal responsibility to report a captain who's incapacitated?"

"Captain Weskind is *not* incapacitated!" I realized I'd yelled and my face felt hot. Halley's non-expression hadn't changed, but I tried to speak more calmly. "She needs a little extra help. That's all. She's in command."

"I see," Halley answered again in a tone that conveyed nothing. "How long have you known Captain Weskind?"

I rubbed my face with both hands, feeling embarrassed. "Since Galpin Prime. The *Lady* was in port. I met Captain Weskind there. I was just a kid."

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"Galpin Prime." Halley pondered the name. "Not exactly the finest planet in the known universe."

"It's a cesspit. It's where I grew up." I looked away again, fighting off memories. "No hope and no way out. Until I met Captain Weskind. She didn't have to spend a moment on me. Not *one*. But she noticed me. She offered me a job on the *Lady*."

"As First Officer?"

"As a deckhand. I worked my way up. All the way from the bottom. Captain Weskind believed in me."

"She didn't have multipolar then?"

"No. At least, it hadn't manifested itself."

"So, you owe her . . ."

"Everything."

Halley nodded slowly. "Does she know her ship is running drugs?" I didn't say anything, taking refuge in silence for a moment. "Kilcannon, I can read cargo manifests and I know when they don't make sense. I know what's really in those cargo containers."

I grimaced. "Technically, we're not 'running drugs.'"

"Technically. All you've got is the precursors used to make the drugs. Do you think that's going to save your necks if you get inspected by peacekeepers?"

"I don't know."

She looked more exasperated than anyone I'd ever seen. "You're going into Fagin Star System with an illegal cargo. If any privateers try to jump you, which has a very good chance of happening, you won't be able to call for help because the peacekeepers will confiscate your ship once they check the cargo. Then they'd throw you in jail. At least the privateers might let you go if you take off in the lifeboat."

"Look, Halley, you know the *Lady* broadcasts her condition to anyone looking. The engine output, the energy readings, the shield fluctuations, anyone who sees her is going to know she's a tramp. And they'll leave her alone because a tramp isn't going to be carrying anything worth the trouble."

Her eyes reflected disbelief now. "That's your plan? To count on the poor condition of your ship to protect you?"

"We don't have any other choice." I clenched my fists, staring past her. "You said it. The *Lady*'s at the end of her rope. We need to make a decent profit on this haul. Enough to get a few repairs done. That's all we need. Just that one break. Saints forgive me, I'm not proud of this. But it's our only chance. The only chance left for the *Lady* and for her crew."

Halley regarded me, her face hard. "And for Captain Weskind. What happens to her if she loses this ship?"

"I . . . she won't."

"There are places that would take her."

"It'd kill her." I calmed myself again. "The *Lady*'s her life. I'll do what I have to do to save her."

"*Anything* you have to?"

I sat silent again for a moment. "No. Only whatever Captain Weskind would approve of. Or . . . understand." I closed my eyes, not wanting to look at Halley for a moment. "We had offers to run weapons into Fagin, you know. They would've paid better than the cargo I took."

"But Captain Weskind wouldn't have understood running weapons into a place where people are slaughtering each other."

"No, she wouldn't." I opened my eyes and glared at Halley Keracides. "And she taught me there's some cargos you don't touch no matter what."

"She must have been . . . she must be a fine Captain."

"She is. Don't tell anyone what I told you about her."

"Captain Weskind? You forgot the magic word."

"Please."

"I promise." She stood up and stared at me. But Halley Keracides didn't say anything else and after a long moment she left the bridge to me and the blank

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displays.

"First Officer Kilcannon?" Able Spacer Siri stood there, still thin as a refugee but with her eyes clear. "I . . . I wanted to thank you." Her eyes shifted and she spoke with almost desperate haste. "The dust would've killed me. Sure as hell. I was halfway there. I knew my only chance was to get away, on a ship where I couldn't get any no matter what, but nobody'd take a duster. Except you. I got clear of it, thanks to you."

I shook my head. "I just needed another spacer, Siri. Thank Captain Weskind. She's the one who gave you a chance."

Siri's eyes shifted again. "Uh, yeah."

"I'll let the Captain know you're grateful and you're clean."

"Uh, thanks."

We finally broke out into normal space, high above the plane of Fagin system, looking down on a small area of space where human rationality had been in very short supply for too long. As *Lady* dove down toward the fourth planet in the system we listened to news reports and shook our heads over the latest atrocities.

Two inhabited worlds and a slew of lesser bodies with colonies on them left too much territory for the peacekeeper forces to cover. Watching the news reports, it quickly became clear that whenever the peacekeepers scrambled to halt an outbreak of fighting in one area the people in the places they'd left would immediately start raising hell. From our perspective, that was good. It meant the peacekeepers wouldn't have any leisure time to wander about and investigate the small freighter coming in outside their normal patrol areas.

But everything wasn't great. From our position above the plane of Fagin's system, we could easily see all the ships operating below us closer to the plane. Two of them, one good-sized and one a bit smaller, showed up as freighters but were loitering not far from the area we'd pass through en route to the fourth planet.

"Privateers?" Halley asked me.

"Yeah. Sure to be. You know as well as I do that freighters hang around ports, waiting to off-load or on-load. They don't hang around the middle of nothing."

"Even with freighter engines they wouldn't have trouble intercepting us. What are you going to do, Kilcannon?"

"Keep going, cross my fingers, and hope they either ignore us as not worth the trouble or something else happens to distract them."

Halley Keracides just nodded and watched the readouts for a while with me.

There's a reason the old saying warns to be careful what you wish for. Less than a day later we were watching news reports of the latest mass slaughter by the good people of Fagin system. There was (or rather, had been) a colony on a moon of the fourth planet, which was (or rather, had been) inhabited by a group most of the people on the fourth planet didn't like for some reason. The peacekeepers protecting it had been drawn away and the fourth planet people had struck.

"Saints, what the hell's the matter with them?" Chen asked, not bothering to hide his revulsion.

"I don't think there're any saints watching this system," Halley Keracides answered.

I was watching something else. "There's a ship heading out our way." They followed my mark. "Looks to be an old freighter. A lot bigger than *Lady*, but a bit older, I think, from the readings we're getting."

Within another six hours we'd seen news reports confirming that the old freighter had come off of the moon where the colony had been wiped out. Nearly wiped out, that is. They'd gotten most of their kids and some of the adults onto that freighter. Its path to the peace-

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keepers or other safety in-system blocked by hostiles, the freighter had hauled mass out of the plane of the system in the hopes of getting away.

Our two loitering privateers started heading for it. They'd been well positioned for an intercept and they'd catch the fleeing freighter. No question. About two days before the nearest peacekeeper ship could possibly arrive to protect the freighter. And just a few hours before we swept safely past on our way to that fourth planet.

"You've got your distraction, Kilcannon," Halley Keracides stated in a very quiet voice.

"Go to hell."

"What are you going to do?"

"There's nothing we can do. *Lady* doesn't carry weapons. She's old, she's tired and we can't do a damn thing."

Halley nodded, but she didn't seem to be agreeing. "Maybe you ought to brief Captain Weskind."

If I'd spotted even a trace of mockery on her face or in her voice I'd have sealed her in her quarters until we hit port, but there wasn't any of that. "I should," I agreed, and left to do that.

Captain Weskind sat and listened. She always sat while I talked, and after I'd finished I waited. But Captain Weskind didn't recite her hopes about "one good run." She just sat there, her face flickering with rapid shifts in emotion, and after a while I excused myself and went back to the bridge, wondering if Captain Weskind had taken a turn for the worse, or if she could no longer say whatever else she might've wanted to say.

The two things nightmares have in common with space is that you can fall and never reach bottom, and everything happens in slow motion. The old freighter was running for all it was worth, but the privateers were closing fairly easily, and because of the distances involved it was all taking days to play out. Yet I could read the end without any trouble. I'd been driving ships a long time and could handle relative motion by instinct. I didn't even need to consult the maneuvering systems to know about where the privateers would catch the freighter.

Since the freighter had come out of the area of the fourth planet, the same area we were headed, and had run in our general direction, the privateers would catch it pretty damn close, as space goes, to where Lady would pass. They'd be busy killing the kids and looting the ship, of course, so they wouldn't spare a glance at us.

We'd just have to watch it happening.

And Halley Keracides watched me. She didn't say any more, she just watched me and the readouts, where as the hours spun down prey ran and predators chased and the *Lady* got ever closer to both.

There are always points of decision when you're driving a ship. Given your mass and your engines you can tell how long you have to make up your mind before it's too late to be able to do something. We were six hours from the place where the pursuit would end. Halley Keracides and I were the only ones on the bridge of the *Lady*. She stayed silent, but we were coming up on that point of decision soon and I finally had to say something. "Just one good run."

Halley Keracides nodded. "And one more after that?"

"Yeah. That's all *Lady* needs, right?"

"No. Not really. But you've got a clear shot at it."

"At the fourth planet, you mean."

"Yes. If that's what counts."

I kept my eyes on the displays. "And after we deliver our cargo we'll have to find something in Fagin system that people will pay to have delivered to another system."

"The people you deliver that stuff to will have something they want you to haul. Count on it. Whether you want to haul it is another question."

"This is an honest ship. I swear."

"Today, I'll agree with you. Tomorrow, maybe not. What course do you want to

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steer, Kilcannon?"

"I know what course I won't steer. But . . . damn. One or two runs . . . we could get them done and then drop that crap for legit cargo again."

"Is that what you think?"

"I don't know."

"What's Captain Weskind think?"

I didn't want to hear that question. But Halley Keracides looked and sounded sincere when she asked it, and I knew it was a question I ought to know the answer to. "I'll brief her on our options."

"So now you think you have options?"

"For a little while longer, yeah."

Captain Weskind wasn't awake but this was a critical time, and any Captain knows they'll be awakened when necessity calls. I talked to her, laying out the situation again. I discussed options, I made a recommendation. I waited.

Captain Weskind sat there. Not a word, and too many changes coming too fast in her facial expressions for me to even try to read meaning. Feeling an ache inside, I prompted her. "This could be a good run. The one we've been waiting for."

But she didn't respond. And I knew I had my answer. Captain Weskind had given me that answer a long time ago, when I was new to the *Lady* and she was teaching me the ropes. Small players in the freighter trade sometimes had to take a flexible approach to rules and regulations. But she always told me there were some cargos you didn't take on, some things you didn't do. And some things you didn't let happen if you could do anything about it.

Halley Keracides was still on the bridge. She looked a question at me, but said nothing. I did some calculations, then I adjusted our course a bit, sat back and waited.

"You're going to come a lot closer to those privateers," Halley observed.

"Yeah." I called engineering. "Vox, I want you to rig the autos so they can best handle all engine functions, even emergency damage."

"Can't."

I muttered a prayer to any saints watching. "You need to do your best."

"Already did."

"In a few hours I'm going to have you evacuate engineering and stand by at—"

"No."

"Dammit, Vox, what's the problem?"

"Saw the course change. Know what you're gonna do. Go help them kids. Gonna need us here. We're staying."

For the Chief Engineer that amounted to a very lengthy speech. "Okay. But when I say you have to go I want you guys out of there as fast as possible. Understand?"

"Aye."

Halley was watching me again. "What?" I demanded.

"Just wondering what you're planning and what I can do."

"I'm planning on using the two weapons available to the *Lady*."

Her eyebrows rose. "I didn't know you had even one weapon on the *Lady*."

"People are clever, Ms. Keracides. We can turn all kinds of things into weapons. As for you, I'm going to have you and the others from the *Canopus* suit up and stand by at the lifeboat."

"Chen will insist on staying in engineering with your people."

"Fine, the other five of you will go the lifeboat."

"Why are we going to need the lifeboat? You're not planning on putting us off while you somehow go into battle, are you?"

I took a deep breath. "No. We're all going to need that lifeboat."

Word spread through the crew. I waited for a mutiny that didn't happen. I told everyone to suit up. Once the privateers figured out that *Lady* might be a threat they'd open fire. It wouldn't take many hits by them for *Lady* to lose atmosphere.

I left Halley Keracides on the bridge for a few minutes while I went back to Captain Weskind's cabin and got her

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into her own suit, then pressurized it. "I'll be back, Captain. Just wait for me and don't worry."

Halley was in her suit by the time I got back. The Vestral Company suit she wore looked new or very close to it. I couldn't help comparing it to the suit I had on, which in its patches and worn fittings betrayed every hour of too much use over too many years. But if Halley Keracides noticed the differences between our suits she didn't show it.

One hour out. I called for more thrust from *Lady*'s engines, and the old girl started putting on more speed. That called for another adjustment to our course. Down and off to the side we could see the privateers closing on the big freighter. So far they hadn't paid any apparent attention to us. I tried to match a freighter-turned-privateer mentality to my own experiences and wondered how long it'd be before they started worrying that *Lady* was more than just a tramp freighter trying to sneak past them.

By adding speed I'd set us up to intercept the privateers a bit earlier, at a point a little further from the big freighter than before. I didn't want to risk them shooting up the freighter any before I got there.

"Why haven't they opened fire on the freighter already?" Halley asked.

I made a sour smile. "You wouldn't understand, I guess. When you think of spare parts you think of going to a shop and buying them new. Ships like the *Lady* live on what we can salvage. I know what they're thinking. They don't want to damage stuff on that ship. They're going to overhaul that freighter, put in a few well-aimed shots at close range to knock out his ability to maneuver, then board, space the kids and strip everything off the freighter that they can use or sell."

"Why not just keep the freighter?"

"It's too easy to track stolen ships. It's hard to track stolen parts." Halley at least had the grace not to remind me that I'd already demonstrated my knowledge of the illicit parts market.

An alarm pulsed and I watched the readouts tell me a chunk of metal had just raced past us. "I guess that was a warning shot."

Halley nodded. "They're using railguns."

"Sure. The electromagnets are easy to build and maintain. And the metal blocks they use for ammo are cheap and really easy to manufacture. Just the thing for a bunch of people who want to keep shooting at each other for a long time."

"What are you going to do about the warning shot?"

"Ignore it. By the time they figure out I'm ignoring it we'll be a lot closer."

"You're going to get a whole lot closer, aren't you, Kilcannon?"

So she'd guessed what I intended doing. "Yeah. I can't act too soon, though. I have to wait as long as possible or they'll be able to get up enough relative speed to dodge us." I checked the distance and the time. Not much than another half-hour. "I want you to get down to the lifeboat now. You, the others from the *Canopus*, and the rest of *Lady*'s crew. Get into the lifeboat and stand by."

"How sure are you that the lifeboat isn't going to be hit when they start shooting at the *Lady*?"

Not sure enough. "The lifeboat is out on one side of the ship, and the privateers will be aiming at *Lady*'s center to maximize their chances of a hit. The lifeboat should be okay even if the privateers really shoot us up while we're closing on them."

Halley eyed me. "Tell me you're not going to ride *Lady* all the way in."

The thought brought a shiver up from somewhere deep inside me. "Hell, no. But it'll be close. It has to be. I need everyone else at the lifeboat waiting."

"All right. The saints know you've promised to try and make the lifeboat, Kilcannon. You don't want to meet them with a broken promise fresh on your record. Remember that. For my

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part, I'll keep that lifeboat waiting as long as I can." She hesitated. "Should I get Captain Weskind?"

"No! She won't go with anyone but me. I'll bring her with me."

Halley Keracides looked like she wanted to argue, but then nodded and left. About ten minutes later she called the bridge and reported that everybody was at the lifeboat. Everybody but the guys in engineering, Captain Weskind and me.

A moment later another metal projectile whipped by *Lady*. I wondered how long they'd give me to react this time. But it hadn't been a warning shot. More projectiles came in, aimed straight at *Lady*. I heard and felt the impacts, grateful that the storage spaces in the bow were taking the brunt of the first volley. That's why they were there, to absorb damage if *Lady* hit something or something hit *Lady*.

But storage spaces aren't armor and those metal projectiles were fast and heavy. There was a pause of a few minutes after the first volley, apparently to see if we'd take the hint after actually being hit, then more rounds started coming in. This time they started punching through. Tiny hurricanes roared through *Lady* as the shots from the privateers ripped holes in her. Atmosphere vented from a score of holes in the hull, pushing *Lady* slightly off course as they did so. I corrected the course and watched the instruments report dropping air pressure until every compartment in the ship was in vacuum.

I checked the readouts again, watching the paths the other ships made as they swung through space, and I knew it was time. I brought *Lady* around, finally steadying her pointed at the spot where the smaller privateer would be in fifteen minutes. The barrage of projectiles halted for a moment as my course change avoided shots aimed at the place where *Lady* hadn't gone. In the momentary calm, I popped a console I'd never opened in earnest and threw two switches.

On the outside of the hull, massive grapples opened and electromagnetic pushers engaged as the emergency cargo jettison system activated for the first and last time on *Lady*. The big cargo containers which ringed the ship at two places were pushed away from *Lady*, slowly spreading out around the course she was on. As the last containers cleared the hull I goosed *Lady*'s engines to the maximum we could manage. The old girl shook and shuddered, but she accelerated away from the containers, leaving them traveling behind us down the same course. As I turned *Lady* slightly again, I watched as the delayed commands I'd fed to the cargo containers activated and they started offloading drums of precursor chemicals through load points located on their tops and bottoms, the drums drifting into the areas between and among the big cargo containers. Good riddance to a cargo I never should've loaded.

In the process of clearing my conscience I'd also created a huge shotgun blast aimed for the point the smaller privateer would reach in twelve minutes. I wondered how long it would take the privateer to spot what I'd done, figure out what it meant and try to alter its trajectory. It shouldn't matter. Freighters, even freighters fitted out as privateers, weren't designed to dodge wide debris fields aimed right at them.

I steadied *Lady* just short of a collision course with the larger privateer. The longer I could leave that privateer thinking I was only planning a close firing run, the better.

Ten minutes. "Vox, evacuate engineering *now*."

"This is Chen. Vox is dead. We took some hits back here and suffered power arcs."

Damn. "The rest of you get out of there and get to the lifeboat."

"How much longer—"

"Go!"

"Aye, aye. On our way."

Lady's hull twitched and rang with

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impacts as kinetic rounds from the privateers hit again and again. I sat there, watching compartments and systems report damage or just go dead as the solid metal chunks tore into and through *Lady*. I wondered what would happen if a round came through the bridge. Would I have time to realize it or would I just find myself face to face with Dingo, him demanding to know what I'd screwed up this time? Eight minutes. Close enough and maybe too close.

I made a small course correction, finally fixing *Lady* onto a collision course, then I locked the docking system onto the big privateer and deleted the engine braking and maneuvering overstress limitation sequences. *Lady* would steer herself directly at the privateer, engines going full blast, as long as her systems still functioned. I stood up, fighting for balance as *Lady* jerked to maintain her lock on the big privateer, and stared at the screen where the shape of the privateer loomed. Then I ran for the Captain's cabin.

Captain Weskind was there. Face down on her desk. She'd opened her suit. There wasn't any time to see how long it'd been open and how badly she'd decompressed. I sealed the suit and repressurized it and sat her limp body on the edge of her desk and turned my back to her and draped both her arms forward over my shoulders and grabbed her hands and lifted her on my back and ran for the hatch.

I staggered down passageways that swung wildly as impacts and sharp maneuvers to keep the ship aimed at the privateer altered *Lady*'s motion. The lights flickered, caught, then finally died, leaving dim patches where the few working emergency lights came to life. What must have been a metal projectile from one of the privateers burst through a bulkhead three meters in front of me and went corkscrewing on, chewing another hole through *Lady*'s guts.

Ten meters from the lifeboat access, the deck suddenly bent and rose on one side, then the bulkhead slapped me. I hit the other bulkhead, my vision graying out, then managed to get to my feet again, Captain Weskind still a dead weight on my back. Something inside *Lady* screamed as it tore under stress, the sounds transmitted through her structure and into my suit. She was dying. Saints forgive me, she was dying. I stumbled down the weirdly narrowed passageway to the junction, then one more meter to where outstretched arms waited.

Captain Weskind was pulled from my back and then I was pulled in as well, the lifeboat hatch slammed shut almost on my feet. I felt the hard deck beneath my back and remembered the lifeboat was overcrowded. People were screaming but my head was swimming too much to understand. Then a great hand pressed on me as the lifeboat accelerated away from what was left of *Lady*, putting everything it had into getting away. I struggled to breathe as a couple of bodies lying partly across me tripled in weight.

A black fringe grew around my vision as I lay there, but I kept my eyes fixed on the display screens at the front of the lifeboat. The one in front of the piloting station showed only the spinning star field, but the auxiliary screen was locked on the area where *Lady* was still heading.

The big privateer was accelerating, trying to get up speed, finally realizing *Lady* was playing for keeps, but its own mass and inertia were holding it back. *Lady* came down on it, moving so much faster under her long acceleration that the old freighter seemed like an arrow. The privateer was still firing, but the shots were only chipping pieces off *Lady*. They couldn't stop or divert her.

Lady roared down from above like the angel of death and struck across the privateer at an angle. I fought back the blackness and what might have been tears as *Lady*'s old hull bent around the point of contact. The privateer's hull

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bent, too, curving upward on either side of the impact. I could see hulls shredding, compartments blowing open under the stress and spilling their contents into space, countless minor detonations rippling through the merged wreckage as systems and structures failed explosively. A cloud of vented gases blocked direct view of the wrecks as they spun off, locked together in their death throes.

Off to the side, the slower-moving cargo containers and cargo drums were coming down on the smaller privateer. It was moving, too, trying to dodge the field of debris. It almost made it. Drums hit, denting the hull or punching through, but the smaller privateer managed to hold its course. Then a big container clipped its bow. The privateer shuddered and lurched off to one side under the impact, directly into the path of another container. The second one hit aft and hit hard. I watched energy flare and knew the privateer's engines had slagged. The smaller privateer staggered into an erratic roll, taking more glancing impacts as it spun away.

I couldn't see the refugee ship. I couldn't remember where it was supposed to be relative to us now. I tried to find it but my head hurt and I felt very tired and it was too hard to keep that blackness out of my eyes, so I let it fill my eyes and my head and let the pain go away.

I opened my eyes and saw light again. Smooth light, steady light. I blinked, turning my head to see what looked like a very well appointed sick bay. I turned my head the other way and saw Halley.

She nodded at me wordlessly, waiting for me to speak.

"This doesn't look like a peacekeeper prison infirmary."

Halley twisted her mouth into a sardonic smile. "No. The peacekeepers figured they owed you one. You're on the Vestral ship *Fenris Rising*. Outbound from Fagin."

"Oh." I thought about that. "*Lady* . . ."

"The collision totally destroyed the larger privateer. The smaller was knocked completely out of commission by the impacts of the cargo containers. The peacekeepers rounded it up a few days later."

"A few days later." I lay back, feeling a lot more tired than someone who'd been asleep for at least that long ought to feel.

"Peacekeepers picked us up. Good thing. That lifeboat of yours wasn't in very good shape. Neither were you. Concussion, a few broken bones. That kind of thing. The refugee ship made it, by the way. They're safe."

So *Lady*'s sacrifice hadn't been in vain. I nodded.

"Captain Weskind would be very proud of you, Kilcannon."

"Captain Weskind—" The question stalled as I saw the look on Halley's face.

"She's dead." Whatever Halley saw in my expression made her lean forward a bit and squeeze my hand. "You did everything you could. Her suit must've been open at some point. Yes? She'd suffered too much decompression. You got her onto the lifeboat, but it was too late."

I was silent for a long time, letting the sorrow roll through me. And the guilt of relief. Captain Weskind had died on the ship she loved. Maybe she'd understood enough of what was happening to make that decision. Now she'd no longer have to face a universe her mind couldn't deal with anymore. Now she wouldn't have to try to go on without the *Lady*. But when everything else had passed, one thought still stung. "I think I remember her being pulled on the lifeboat before me."

"That's right."

"The Captain should've been the last one to leave the ship."

Halley leaned back again and regarded me. "The *Lady*'s Captain was the last to leave the ship."

"You just told me you took Captain

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Weskind onto the lifeboat first."

"So I did." I waited, but she didn't explain her statement. "Any more questions?"

"Yeah. Who the hell are you?"

Halley gave me that twisted smile again. "I have a confession to make, Kilcannon. Keracides isn't my real name. My actual name is Halley Vestral."

"Vestral?" The name took a minute to connect. "As in Vestral Shipping?"

"Yes. My mother's the majority owner."

I inhaled deeply. "I wondered why First Officer Chen deferred to you. As if you weren't just some passenger."

"He knew who I was and so did the Captain of the *Canopus*. Nobody else on the ship did. Mother and I often travel under false names for security reasons."

"Good thing, I guess. Why tell me now?"

"Because I want to offer you a job, Kilcannon. After consulting with the Vestral Shipping officers and sailors who observed you on the *Lady*, my mother agreed without reservations."

A job. With Vestral Shipping. On a bright, clean ship. "That's . . . thank you. I, uh, know I'll need to work my way up from whatever I'm hired at—"

"The job offer is for Captain of one of our ships."

I just stared for a long moment. "I'm not qualified."

"We think you are."

"I've never served as a Captain."

Halley started to speak, then paused. Eventually, she just nodded. "We think you're qualified," she repeated.

"What about the rest of the crew from the *Lady*?"

"I knew you'd ask about them. We'll find positions for all of them." Halley paused again. "That System Tech. Siri. Some people were panicking while we waited for you in the lifeboat, trying to get us to go. She kept her body across the lifeboat hatch so no one could close it until you got there. She's awful strong for such a small girl."

"I'll have to thank her, if I ever see her again."

"You will. She's signed on as crew on this ship." She saw my face. "She's clean now and deserves the opportunity. It's the least I could do, Kilcannon."

"Uh, thanks." The word felt so hopelessly inadequate, but what could I say that would convey what the offer to me meant? I wouldn't be roaming the docks, trying to find another old ship willing to hire me on as, maybe, Third Officer. Instead, I'd be Captain of one of the bright, shining ships of Vestral. With a full crew and a maintenance budget. Good runs to good planets.

I ought to feel something.

I leaned back against the bed, wondering why everything seemed so empty. Here was everything I'd ever dreamed of, everything I'd ever envied, everything I'd ever wished for. I had it. "Why aren't I happy?"

I hadn't realized I'd spoken that until Halley shook her head. Her eyes were looking right into mine, as if she could see something there. "I'm sorry. You aren't happy because you know the odds are vanishingly small that you'll ever find Haven again."

"Haven? What are you talking about? I've never found Haven."

She smiled that not-a-smile again and shook her head once more. "You still don't know where Haven is?"

"I've never known where Haven is. And I thought you said Haven isn't real."

"No, I said there isn't any *one* place which *all* sailors could call Haven. But it does exist."

Riddles. I couldn't handle them at the moment and broke eye contact with her, staring up at the overhead. "Then where is it?"

"Kilcannon, you fool. Haven is that place you most want to be, the place that holds everything important to you."

When I looked down again she was walking away. I wondered what she'd meant.

Saints, I miss the *Lady*. ■

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Numismatist

Richard A. Lovett

Seamless interfacing between people and their machines makes it easier to do things—all kinds of things.

What made Steve Simons' death unusual wasn't that he met his end in a hail of bullets. Nor was it that he died proclaiming himself to be an instrument of God's wrath. Events like that are depressingly common. The strange part was that up until the day of his demise, Simons was a Presbyterian elder.

Presbyterians make a fetish of doing things decently and in good order. Translation: slowly, carefully, and unemotionally. I know. I grew up among God's frozen-chosen. One winter, my brother and I wanted to put a bin in the narthex to collect coats for the homeless. Everyone thought it was a great idea, but by the time the Outreach Committee approved, and Property and Worship weighed in on location and décor, it was swimsuit season. My point is that Presbyterians are *not* known for walking into shopping malls with handguns and opening fire on tattooed teenagers, screaming about how they've made desecrating abominations of their pierced and painted bodies.

"It's just not the type of thing Steve would do," the Reverend Melissa MacDonald was telling me for the fourth or fifth time. "You can't imagine a sweeter, quieter guy. I've never seen him get angry at anything—not even to raise his voice. I just can't imagine him doing such a thing."

What she was giving me, of course, was a textbook profile of a repressed-anger killer: the type of guy who stores up every tiny insult, every little provocation, until something pushes him over the brink. I know that, too. My name is Adam Lamb, and I'm a psychological consultant to the Metro police force. That means I've seen way too many textbook killers. I wasn't even surprised that he was deeply religious: I've also seen more than my share of God-fearing family men turn guns on children, spouses,

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and themselves. Some are psychotic. Some think they're sending their families on shortcuts to heaven. Some just don't care anymore. Almost all were sweet, quiet guys whose friends struggle through denial, just as the Reverend Melissa was doing now.

In her heart, Ms. MacDonald knew as well as I did that her parishioner had managed to fire off three full clips of bullets before police and security guards swarmed the scene. Luckily, he'd been a lousy shot, and had barely managed to nick his intended targets. At worst, a couple of them would have interesting scars to explain in old age, along with those from the tattoos they would someday be having removed, when the fashion pendulum swings and body art goes the way of bobby socks. What I wanted to know was why Simons had done it. If there was a why. Sometimes, there isn't—at least not one that makes sense.

"He even worked with our youth program," Ms. MacDonald added.

"In what capacity?"

"Each summer we do a mission trip. Last year, the kids went to Mexico to build a community center. This year, they'll be on the coast, helping low-income families repair flood damage. Steve was one of the counselors. I don't think he's missed a trip in a dozen years." Her voice caught. "Well, I guess he's missing this one." Another pause. "The kids loved him. He did lots of other things with them, too. He was single, lived alone, said it gave him lots of time."

I digested that for a moment. A youth-group advisor who watched kid-culture decline, year after year, feeling that the world was accelerating toward total decadence? Hell, that described everyone over thirty. But youth advisors tend to be nonjudgmental. Could one internalize all of the judgments everyone else makes, until eventually he explodes? Theoretically possible, but unlikely, my intuition said. Still, when the guy blew up, he'd started shooting at kids. There had to be a connection. I was surprised the Reverend Melissa didn't see it. Well, almost surprised. Denial is powerful. I know about that one, too.

I wasn't sure what to expect from the bachelor pad of a Presbyterian elder. Hopefully no kiddy porn, but who knows? Plenty of staid religious groups have found themselves harboring pedophiles. Still, Simons had *shot* at kids, not abused them. The profile said rage—tightly controlled and probably not well recognized until the end. If you'd asked me to guess, I'd have predicted Spartan furnishings, with a place for everything and everything in its place: the lid tightly clamped on simmering anger. Either that or a trashed apartment in which he'd vented his fury in symbolic form before carrying it to the mall.

The address was in a neighborhood called Rhododendron Hill: an area of gingerbready Victorian houses and ancient trees arching across the street. The trees were nature's own cooling system—so effective that most of the houses had never installed air conditioners and people still sat on porches, watching the world go by. Not exactly the place for a recluse trying to conceal an anger problem.

"Here we are," Detective Morris said as he pulled his latest experimental car to the curb. Morris is an impassive fifty-year-old with whom I've worked on more cases than either of us could easily count. We like each other, I think. At least, we work well together. Morris gets me access to things I need to see, then stays out of the way while I try to get into the head of a victim or a perp or a witness. Maybe what I like about him is that he keeps to himself, never asks personal questions. I'm not a counselor; I'm an observer. My job requires empathy but doesn't require me to bare my soul to anyone. I like it that way.

Morris is a gadget freak who uses his seniority to commandeer the latest

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equipment. Like the little save-the-planet car we were driving today. It had all the acceleration of a golf cart but got enormous mileage out of its hybrid natural gas/electric motor. Morris-the-gadget-freak envisioned a future in which filling stations would be unnecessary and you could recharge such things simply by swiping a credit card and hooking them to natural gas taps that would be as common as parking meters. Morris-the-cop knew this wouldn't work without a foolproof way to make the system safe from kids with matches. As long as I've known him, he's struggled with these two sides of his personality: the geek who loves inventions and the cop who knows that the first thing that happens with any new discovery is that someone figures out how to sabotage it just for the hell of it. The car itself was a mixed blessing. Great for puttering around town on an investigation, hopeless for chasing perps in muscle cars. Which was fine by me. High-speed chases aren't part of my job description, either.

Simons had lived in a newer building, although in this neighborhood, "newer" meant anything after 1900: a squat, stucco affair with a flat roof and no gingerbread, but lots of trees. The first-floor apartments had porches framed in colonial-style pillars that provided support for equally spacious second-floor patios. No barbecue grills, but lots of deck chairs, chaise lounges, and even picnic tables. An all-round friendly looking place. On one of the upper patios, a twenty-something woman was celebrating the afternoon by displaying a pale yellow Jogbra and cycling shorts to the world from a chair positioned as close as possible to the railing. Most likely, everyone in the neighborhood knew her. She had a body to be proud of, and she'd not moved it close to the rail in search of sunbeams. At this time of day, the trees pretty much shut off all opportunities for melanoma.

"He lived up there," Morris said, pointing to the adjacent patio.

The inside wasn't anything I would have predicted.

The first thing I noticed was that Simons was a bibliophile. It was hard not to notice: no less than six floor-to-ceiling bookshelves lined the walls of the living room alone, with heaven knew how many others in the apartment's back rooms. Additional books were piled on end tables, the floor—even the TV.

"Can I touch?" I asked.

Morris nodded. "The crime unit's already been over everything. Just put things back where you found them." His nose wrinkled in distaste. "If you can. How could he live like this?"

Easily, I thought, as I glanced at the spines of the books piled haphazardly on the end of the coffee table nearest a comfortable-looking chair. These would be the ones Simons had been reading shortly before his shooting spree. If I were lucky, there'd be titles like *What's Wrong with America's Youth?* or *A Generation of Slackers, Out of Control.* But the raciest I found was a Nevada Barr mystery, with a bookmark ninety percent of the way through. I myself had read that book a few months ago: a real page-turner with a half-dozen major surprises before the end. Years ago, my grandmother had died in her sleep, sitting in her favorite reading chair with a book on her lap. I'd been ten at the time, and whenever I start a good novel, I have an irrational fear that I too will die without finding out how it ends. Someday, of course, that will happen—I'm always midway through three or four books at once—but Simons had deliberately chosen to exit the world a mere thirty-four pages before finishing his novel. Very strange.

The rest of his books were interesting mostly for their lack of interest. Nothing about the decline of American morals. No militant fundamentalism. There was a book by Dietrich Bonhoffer, a German theologian who, if I remembered correctly, had been executed for taking part in a plot to assassinate Hitler. But it was a

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major stretch to extrapolate that to randomly shooting at kids in a mall. Not to mention that the plot against Hitler was well organized, while Simons' assault showed every sign of impulse: the man hadn't even learned to shoot straight.

I set down the Bonhoffer and turned to Detective Morris. "Have you traced the gun yet?"

"Yes. He stole it from his neighbor."

"*What*?" I tried to square that with the woman in the Jogbra, lounging so nonchalantly on her balcony. "Why'd she wait so long to say anything?"

Morris gave his closest approximation to a grin, which isn't all that close. "Wrong neighbor." He jerked his thumb the opposite direction. "That one. He didn't report it because he was on vacation. Still is, for that matter. Simons was feeding his cat. Tracing the gun wasn't the lab's highest priority, then it took a while to find the guy." Morris propped his backside against a wall. "He wasn't too happy when the Maui police pulled him in for questioning. I was getting the report while you were in church. Did you learn anything from the pastor?"

"Our guy's a Boy Scout."

Morris snorted. Or maybe it was a laugh. "Aren't they all?"

"Anything worth seeing in the neighbor's apartment?"

"Don't know. He gave us permission to look, but not to break down the door. Someone's on the way over with the key—at least I hope it's the right one. There was an unidentified key in Simons' pocket. If it doesn't work, we'll need a warrant."

"So our guy goes next door, grabs the pistol, and heads for the mall." This was beginning to look like the most impulsive impulse killing I'd ever heard of. According to the preliminary report, Simons hadn't even taken time to lock his door before leaving. Though he might well have realized that he wasn't coming back.

I took another look around the living room, then started checking out the rest of the apartment. Everything had the same cluttered feel. But it wasn't oppressive—just full. The guy could have used a bigger apartment. The kitchen was cramped, but semi-tidy. No more than a day's worth of unwashed dishes, an open bottle of wine on the counter. I bent down to assess the level of liquid. Down maybe one-fifth. I couldn't remember any mention of alcohol in the report I'd read before setting out for the church, but maybe toxicology hadn't been any higher priority than tracing the gun.

I glanced at Morris, and he shook his head. "Tox says his blood alcohol was only .02 percent. There's a partial glass of wine on his computer desk. Apparently he never finished it." Morris's tone was dry, but I knew he had to be as baffled as I was. The wine said that Simons wasn't a teetotaler. But even though he'd had the chance to fortify himself with the whole bottle, he'd rushed off to kill without even finishing that which he'd poured. Maybe I should just give back my retainer and admit this one was beyond me.

The computer was in a back room that looked as thoroughly lived-in as the rest of the apartment. A bicycle rested against a wall; telemark skis stood in a niche between two bookcases. Backpacking gear peeked out of an overstuffed closet, and cheerful photos decorated what little wall space wasn't blocked by something else. I studied the pictures, but couldn't find any themes that weren't obvious from the rest of the room: bicyclists on a windy headland, skiers in parkas, cold-looking hikers on a snowy summit. A disproportionate number of kids. Happy kids. If they were any more wholesome-looking they could have modeled for Norman Rockwell.

"From the church?"

"Yeah," Morris said. "You can talk to them if you like." But we both knew what I'd find. The guy was a Boy Scout. Everyone loved him. Hell, the *photos* loved him. What on Earth had caused

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him to snap?

The desk was a different kind of clutter. I'd never seen so much computer equipment in so little space. According to the report, Simons had been a CPA tax consultant, not a computer worker, but computers were obviously one of his passions. He had the latest gazillion-gigahertz processor, a hard drive that could have held half the Library of Congress, three kinds of scanners, photo-quality printers, etc., etc., etc. But the thing that really caught my attention was the neural-inducer headset. Anyway, that's what it said it was on the headband. I'd never seen one in the flesh before—or silicon, or whatever they're made of. Now I understood why Simons lived in this cramped apartment. Tax consultants make decent money, but Simons obviously preferred spending it on toys rather than living space. This particular toy must have set him back at least a couple of months' pay. The ultimate in virtual reality, if it lived up to the hype. Once you got used to using it, you *were* the Web, surfing at will, absorbing information as fast as it reaches your computer—which with this setup would be pretty damn fast.

The headset lay on the desk, atop an assortment of large copper disks—coins about half-again the size of a quarter. I picked one up and examined it. "ONE CENT," it read on one side, surrounded by something that looked like a Christmas wreath. The other bore a bust of someone I didn't recognize and a date that might have been 1798. Or might not have been. The coin wasn't in good condition.

"That's a large cent," Morris volunteered. "Simons collected the things. Apparently he bought them in batches, ten or twenty at a time, from eBay. We found hundreds of them in a safe deposit box."

I nodded. I'd once had a friend who collected old coins. He spent hours poring over reference books, trying to figure out exactly what he had. Early American coins were struck from hand-engraved dies, each slightly different. If you spent enough time studying such trivia as the coiffure of poor old whoever-it-was or the exact layout of leaves in the wreath, you could figure out which die was used for any given coin. Me, I'd been a stamp collector, but it was the same thing. You always hoped the one you were holding was the super-rarity worth thousands of dollars, but of course, if you were the one holding it, you could be pretty sure it wasn't. And in the process of figuring out you weren't suddenly rich, you about went blind staring through a magnifying glass, back and forth between the stamp and the catalog that told you how to tell the difference.

Which raised an interesting question.

"Where's the reference book?" I asked. Simons had left a dozen coins sitting on his desk. They were a lot more valuable than my stamps—he'd not just leave them lying around that way all the time, so he must have been working on them shortly before he headed for the mall. Not to mention that the partially finished wine glass was nearby.

"There isn't one," Morris said. "He was using the computer. It was still logged onto the site when I got here." He checked his notes. "Numismatist something-or-other." He showed me the page, then folded the notebook back into his pocket. "That means coin collector," he added unnecessarily. Collectors love those fancy names. Me, I'd been a philatelist.

I had no idea what to do next, but was saved from having to admit it by the arrival of the key, in the custody of a young officer who barely looked old enough to shave, let alone serve a warrant. When I was in college, we used to joke about how the freshmen got younger every year. Now, it's the cops.

The key worked and Morris led the way inside, stationing the baby-faced pa-

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trolman outside to deflect inquisitive neighbors—although so far we'd not encountered anyone other than the woman across the hall, and she'd stayed on her patio.

Compared to Simons' cluttered abode, this apartment was tidy. Comfortable chairs and a couch faced a thirty-two-inch TV, and books were limited to a single, glass-doored case, half of which was devoted to ribbons, medals, mugs, and trophies topped by gilded figures of pistoleers. A framed and matted newspaper clipping was propped against the back of the case. Curious, I stepped closer and learned that Howard W. Delmoret, then of Rock Island, Illinois, had made the Olympic Trials two Olympiads ago in the rapid-fire pistol event, which I'd never heard of before. A smaller clipping, matted into the same frame, indicated that Howard had finished sixth—good, but not good enough to make the team.

"Quite a 'me' display, isn't it?" Morris said.

"Yeah. No wonder Simons knew there was a gun here."

Morris nodded. "So where do you figure it was?"

"Master bedroom?"

"That would be my guess." He led the way down a short hallway, past a bathroom and a laundry niche barely large enough to hold a stacking washer/dryer. Two doors opened off the hall. The first led into a guest bedroom, as tidy as the living room. The second was closed but not latched. Morris pushed it open, revealing a room that was yet another kind of disaster. Dresser drawers had been pulled out and dumped on the floor, then hurled, empty, into a corner. Capping the mess, the mattress had been tipped off its frame and flopped across part of the pile.

"Wow," Morris said. "So here's where he finally started to vent that rage."

"Maybe. But notice that he didn't touch any of the wall hangings, or rip up the mattress, or do anything nasty like defecate in the middle of that big pile of junk. It looks more like he was in a huge hurry to get the gun, but didn't know where to look."

Morris's gaze swiveled across the destruction. "Doesn't look like he found it here. What do you bet it was in the closet?"

One of my rules of life is to never bet against Morris. We picked our way across the room and pushed open another door, revealing a spacious walk-in. Inside, we found walls of suits, slacks, and shirts, and another mess similar to the one in the bedroom. The light was dim, but not so murky that we couldn't see, atop a pile of debris, a hard-sided case with foam padding shaped to hold a long-barreled pistol. Additional slots held room for five ammunition clips—the three Simons had emptied, plus two more that had been in his pockets. A gun-cleaning kit remained in the case.

Morris squatted down and examined the case without touching it. "I presume it's littered with Simons' fingerprints," he said. "I'll call the lab, but it looks like our boy in Hawaii really didn't know anything about this." He stood up, his knees popping loudly. "Not that I'd doubted his story. It just pays to be suspicious."

I started to respond, but was interrupted by a glimpse of motion in the dark recesses of the closet. For a moment, panic reared—did Simons have an accomplice who was still hiding here? Then I realized that he did have an associate who'd been his ticket into the apartment. I crouched, held my hand out in front of me, and rubbed thumb and forefinger together, all the while making pshh-pshh-pshh noises between my teeth. A moment later, a large gray cat was butting its head into my fingers.

Morris had backed away to keep from interfering. "How do you do that?" he asked. "If I try to call a cat, it's guaranteed to go the opposite direction."

I stroked the gray fleece and was rewarded with a purr. "The trick is not to

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care," I said. "A cat can sense that. If you can convince it that you really don't give a damn whether it pays attention to you, it'll come every time. If it thinks you need it, it'll do the opposite just to demonstrate its independence." I didn't bother to add that not-really-caring was a mental state I'd spent a lot of time cultivating. Luckily, my line of work had a lot in common with calling cats: detachment was a virtue.

We found cat food under the sink and left the animal crunching away while we went back to Simons' apartment. Morris got on his cell phone and asked the crime unit to come take a look at the mess Simons had made of his neighbor's apartment. Not that they were likely to turn up anything useful, other than fingerprints proving that it really was Simons who'd trashed the place, looking for the gun. But the crime unit would be thorough. Sometime tomorrow, they'd give Morris a report that would reconstruct such trivia as whether Simons had swept the books off the shelves before or after he'd upended the mattress. I'd dutifully study it, trying to figure out what that revealed about his state of mind. Two hours later, I'd be no closer to understanding him than I was now. Sometimes, my job sucks.

In the mean time, I took another pass through Simons' abode, trying to make sense of his last minutes of life. According to the preliminary report, he'd eaten dinner on the way home from work at a sidewalk café on Woodburn Avenue, paid for it with his credit card at 6:17 PM, and was home in time to log onto his computer at 6:44. Easy enough to do; Woodburn was only a half-mile from his apartment. That left plenty of time for him to uncork the wine and pour himself a glass. There was no indication that he'd been in any particular hurry. He'd even taken time to read the mail: the crime unit had found a bunch of that day's advertising fliers in a wastebasket. Other mail had joined the clutter on his desk.

Simons had stayed on the computer until sometime after 7:09, which was when his browser log showed him logging onto the coin-collecting site. How long he'd been there wasn't clear because he'd not bothered to log off, but by 8:03, he'd located the gun, driven to the mall, and begun shooting. Four minutes later, he was dead.

In early evening traffic, the mall was a ten-minute drive away. Add another ten minutes for the frantic search for the gun and five minutes to park and take up station in the mall, and that left about twenty-five minutes unaccounted for—an interlude in which there was no evidence he'd done anything other than sip his wine and play with his coins.

"Has anyone done a tox screen on the wine?" I asked. What were those toxins historians think may have caused the odd behavior that triggered the Salem witch trials? Some kind of strange-sounding alkaloid. *Escargot?* No, that would be snails. *Ergot alkaloids*, that was it. Except, they came from moldy grain. What could you get from moldy grapes? Nothing I'd ever heard of, but who knows?

Suddenly I really, really wanted the wine to be the culprit. It was a wish for vengeance, pure and simple—a flashback that struck out of the blue, with a fierceness that was almost palpable. All those kids' families could sue the booze industry and get back at them for— I took a deep breath, forced my fists to unclench, tried to will my heart to slow. That was history. It was over and done with and nothing could ever change it. I would not go there. Yeah, right.

"Yeah," Morris said, in a weird echo of my internal voice. "Something in the wine crossed my mind, too. But it came up negative. Same on the contents of his stomach."

All at once, I needed air. The place stank of stale wine. Morris hadn't said anything, but maybe he didn't notice. I'd never asked him whether he drank. Did-

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n't want to know, because I probably wouldn't like the answer. Still, this place had been closed up for the better part of a day, with that bottle of wine oxidizing in the kitchen. A wine connoisseur wouldn't like it, either. I slid open the patio door and stepped into the muggy-but-fresh afternoon air.

The young woman was still on the next-door balcony, still showing off her Jogbra and shorts to passers-by.

"Hi," she said. "Are you investigating what happened to Steve?" *What happened to Steve*, not *What Steve did*. I knew the next line before she offered it. "I didn't know him all that well, but he always seemed like such a nice guy. Did you know he liked to bake? Last Easter he made these great cinnamon rolls. And at Christmas he made this seven-layer strudel. I think that's what he called it. He said it was an old family recipe. I can't believe he did what they say he did. It's just *not* Steve, if you know what I mean." She reached down beside her and picked up a bottle from the floor. Even from the distance, I could see that it bore the label of a high-end microbrewery. "Want a beer?" she said. "Or is that against the rules?"

I should have responded by asking her more about nice, sweet Steve. Was he really nothing more than a casual friend? If so, did he date at all? Was the nice guy who had all the time in the world and no sign of a woman in his life actually gay? Though there was no sign of a male lover, either. For that matter, what the hell would Presbyterians think of a gay youth advisor? Could fear of being outed be a secret simmering below Steve's nice-guy personality—except that if it had been, why had he finally vented it on kids, rather than whatever real tormentors he might have had? Not to mention that there was no indication he was gay, and today it probably wouldn't matter, anyway. Maybe he was one of those few, fortunate people whose lives revolve around things other than the sex they are or aren't getting.

All of this I should have probed, and more. But I didn't. "Isn't it a bit early for that?" I asked instead.

The only thing I learned from that question was that she wasn't the type to hide her emotions. A stream of them ran across her face in rapid succession: shock, hurt, anger. Nothing that looked like shame or denial—not that it was any of my business, anyway. For a moment, I thought she was going to tell me it was her birthday or something. Even if it wasn't, she had an absolute right to enjoy a beer on her balcony, and I had no right to tell her otherwise.

But instead, she simply shut down. "Whatever," she said. Defiantly, she took a long pull on the beer, then turned her attention back to the street.

Morris had followed me onto the balcony and I could feel his eyes boring into the side of my head, but I refused to look his way. "That was helpful," he said, *sotto voce*.

Not trusting myself to speak, I didn't respond. Looking down, I noticed that my hands were again balled into fists, the arms tensed as though ready to swing. Damn, I thought, will it always be like this? Maybe such things are always lurking just beneath the surface, ready to pounce when the rest of your life gets too weird, like this case that made no sense, and your guard is down. All I knew was that it felt just as it had eight years ago, when the too-polite police officer arrived on my doorstep, calling me "sir" and telling me there was no good way to convey the news that was to follow. That very phrasing itself tells you the gist of the news, but how do you brace for it in the ten-second window such an opening permits? Traci and Michael were gone, the twin lights of my life, extinguished in a heartbeat. Physician, heal thyself. Yeah, right again. Even now, all it took was the smell of stale wine and the sight of a damn beer bottle to bring it all back. Maybe I don't really want it any other way.

I had no idea how much of this Morris

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knew. It wasn't like he couldn't run it down the same way we did the backgrounds on folks like Simons. Simons was the perfect Boy Scout youth advisor. Me, I was the shrink who'd lost his wife and kid at the hands of a drunk driver who at two o'clock in the afternoon had careened across a sidewalk at sixty miles an hour as though he'd drawn a bead on my family. A split second later, he'd killed himself by slamming into a tree, depriving me even of the chance to watch him squirm before a judge and jury. Not that this was an excuse for snapping at the neighbor. She was safely at home, not pub-hopping. But life brands us all with emotional trigger points that can rear up when we least expect it. Most of us, anyway. What if I never figured out Simons' hot buttons? What if he didn't have any, and exploded anyway? What did that mean for people like me who sat in lonely apartments trying not to remember things that could have been?

However briefly, I'd lost control and alienated a witness. I would *not* lose it again in front of Morris. Stiff upper lip and all that crap. "It's the case," I finally said. "I hate these things that make no sense." I walked back into the apartment, resisted the impulse to pour the wine down the drain, and strode out the front door so briskly that I nearly knocked the baby-faced cop off his feet. A moment later, I was on the street, waiting for Morris to unlock his silly little eco-car.

Four hours later, I was back in the apartment, this time on my own. Morris was off duty after a long day, but before he left I'd asked for a copy of the key so I could work some overtime of my own. Penance, I suppose. The woman in the Jogbra was gone, as was the baby cop, which probably meant the crime unit had already done its thing next door and departed as well, leaving the mess for Delmoret to deal with on his return. Welcome home, Howard. I made a mental note to ask Morris whether anyone was feeding the cat.

The remainder of the afternoon hadn't been totally unproductive. After Morris had dropped me at my office (neither of us having spoken on the brief ride downtown) I'd buried myself in a DVD-ROM's worth of security-cam vids of Simons' shooting spree. On my initial review, before going to see the Reverend Melissa, I'd contented myself with the crime lab's 3-D computer reconstruction of the event, as pieced together from cameras with multiple lines of view. But useful as such reconstructions are, they lose detail preserved in the original flat vids.

By the time I'd watched from a half-dozen angles, I was beginning to think Simons' choice of targets hadn't been random. For one thing, he'd shot up a couple of store windows, even though nobody appeared to be even remotely in his line of fire. Apparently, the windows themselves were his targets. More tellingly, he'd let several kids escape without shooting at them.

Setting aside the puzzle of the kids for a moment, I turned first to the store windows. The freeze-framed images were grainy, but it was obvious that one shop was a software outlet, the other a clothing boutique. It was hard to figure out precisely what was displayed in either window, but a few months ago, Morris had given me a copy of the Department's image-enhancement software, plus a crash course on how to use it. My skills were no match for the lab's, but twenty minutes of fiddling brought one of the software store's windows into sufficient focus that I could recognize a display: the life-sized skull and inverted Iron Cross of the DeathQueyst line of total-immersion gaming products.

With that clue, the clothing store fell into place, as well. The particular window Simons had targeted had held an assortment of items too small to identify, but the background was full of black

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leather, studded vests, and mannequins displaying tight, black latex. In another part of town I'd have presumed it was a sex shop, but the mall would have frowned on that. More likely it sold party attire in the DeathQueyst fashion mien.

It's amazing how easily a computer full of fancy software can make you forget about simple, low-tech alternatives. Feeling sheepish for not having thought of it earlier, I looked up the store in the Yellow Pages. In addition to party clothes, it sold amulets, pendants, and "dark-arts accessories"—no doubt the small items in the front window.

I then pulled up freeze-frames of the kids who'd escaped, but they just looked like kids to me. Screaming, running, or in one case rooted in place while Simon seemed to be trying to *shoo* her away. Unfortunately, none had stuck around long enough to be interviewed.

I put in a new DVD and pulled up interview vids from Simons' victims. Someday, I'd have to listen to them all, but for the moment I was looking for the gestalt: an overall impression of the kids Simons had targeted.

At first glance, they were a diverse bunch. There were guys who looked like gangbangers, and girls who looked like prom queens—if prom queens can show that much skin. There was a high fraction of tattoos: not the delicate body art that had originally brought tattooing into the mainstream, but rough stuff: misogynistic, violent, *dark*. The tattoo equivalent of DeathQueyst. One boy also sported a death's head nose ring, and two kids, a boy and a girl, were in full death-rock regalia. Your typical dark-side-of-the-mall assortment.

Sampling the voice tracks revealed more of the same. F-this, f-that, f-the-other. Repetitive rather than creative.

I finished by arraying stills of all of Simons' targets, twenty-some in all, on my screen like so many mug shots in a line-up. The gestalt had become abundantly clear. Simons hadn't been shooting randomly; he'd picked targets that, from his sheltered, nice-guy perspective, looked like bad influences on his Norman Rockwell clones. Perhaps he thought that by eliminating them, he was protecting his youth-group charges from the worst of today's kid-culture. It wasn't rational, but it was the first thing in this case that made any sense at all.

Unfortunately, *why* a sweet guy with no history of violence had suddenly chosen to do this was as inexplicable as ever. Which was why I had decided to relive his last hours as closely as possible.

Before returning to his apartment, I'd begun at the restaurant on Woodburn, mulling over the case as I ate a quiet dinner. At about the same time that Simons had finished his last meal, I paid and walked to his apartment, hoping the exercise would stir something useful from my recalcitrant brain cells.

If it did, I didn't know what it was. In the apartment, I went to the kitchen and visualized the process of opening a wine bottle, wishing I'd brought a cup of coffee from the restaurant. For most people the opening and decanting of wine is a soothing ritual. Needless to say, that's not the case for me. I tried to distance myself from the bad associations, but it didn't work. I was agitated rather than relaxed when I stepped into Simons' spare bedroom and slipped into his computer chair.

The lab had long ago copied the entire contents of Simons' hard disk onto an equally voluminous unit of its own, and I knew the basics of his pre-rampage evening. He'd read his e-mail, deleting spam and answering a couple of bland notes with equally bland missives of his own. "Hi, how ya' doin'? What's the weather in Chicago?" That kind of thing. The most interesting one congratulated a friend on a new job, finishing with, "Drinks after work on Friday? Say, City Club at 5:30?" It was yet another indica-

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tion that Simons was either engaged in a consummate case of self-deception or really believed he had a future to plan.

I shifted to the Internet, logging onto the coin-collecting site to see exactly what he'd been looking at when he abandoned the computer to go searching for his neighbor's gun. The site had a variety of options, of which "large cents, 1793-1857" wasn't the most prominent. Apparently, large-cent collectors aren't exactly on the forefront of the coin-collecting world. I clicked a button and found a bewildering array of options: one of those irritating websites laid out by someone who presumes you already know how to use it. A few random clicks produced nothing useful except to remind me how much time I'd spent that afternoon on my own computer, image-enhancing the damn vids. I don't care how ergonomically your life is arranged, you only have so many clicks in you per day, maybe in a lifetime, before something starts to go. In the months after my family died, I'd buried myself heavily in computers, and my wrists and shoulders had been paying for it ever since.

The neural-induction headset still sat on the desk. Voice-recognition software had taken some of the strain off my wrists, but true VR would relieve it altogether. Or were my present symptoms merely psychosomatic urgings, my subconscious providing a handy excuse to try out the headset? Still, there was no reason not to.

"Unknown user," the screen asserted when I slipped the headset over my temples. "Do you wish to reinitialize?"

I thought about it a moment, then clicked "Yes."

"Initialization will take approximately 10 minutes," the screen informed me. "Continue?"

In for a penny—I clicked another "yes," then called for instructions, which informed me that the process involved reading on-screen material while the interface tuned itself to my brainwave. Not all that different from training a voice-recognition program, but faster.

The computer then fed me a couple of pages of text that told me things I already knew about neural induction, plus a lot of puffery about how it is the ultimate in virtual reality because it bypasses the "bottleneck" of sight, sound, and touch to go directly to the brain's information-processing centers. At the end of each page, I clicked a button calling for "more," wondering whether this really was going to take only ten minutes.

By the third or fourth page, it began feeling like a speed-reading course I'd taken years ago, in which I'd practiced pushing my pace to the ragged edge of comprehension, then pushing one step more, and one more after that. The pages were flying by now, and I realized I was no longer actually clicking the "more" button. I was merely thinking about clicking it, and then watching it click itself before my mouse-finger could react. The pace continued to accelerate until the pages sped to a blur that made my eyes feel grainy, like they'd been exposed too long to a hot, dry wind. I gave a slow blink to try to lubricate them—and discovered that I no longer needed to be looking at the screen.

A moment later, the system informed me, directly in my brain, that initialization was complete. I experienced a brief *now-what moment, then my mind* kicked back into gear and I realized I knew everything I needed to know to use the headset like a pro, that during that high-speed "initialization," I'd read the entire operating manual. But it wasn't as though I'd memorized it or somehow had its full text poured into my memory—it was more like I'd sat down and carefully studied the thing, cover to cover, retaining about as much as I normally would.

I opened my eyes and found that I had a weird kind of dual vision. The spare bedroom was there, unchanged, as was the computer screen, slaved to the inducer input, showing the last page of

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the manual. But overlaying that, in an eerie shadow vision, was my awareness of the Web, spreading before me in infinite possibilities. My newfound "memory" of the manual told me how to shift from one type of vision to the other, and practically without conscious thought, I was doing so, gliding through favorite websites. I tried a MEDLINE search on a topic I'd researched in a few weeks ago, and found my head filled with scientific abstracts, practically in the blink of an eye. Again I had that reassuring sense of having read and processed them all, but not having my brain stuffed full of uselessly memorized text. It was exhilarating. I wondered how much these things cost and my consciousness flowed to a string of websites, offering inducers at "very competitive" prices that I couldn't possibly afford. This thing must have set Simons back a lot more than two months' pay, but in my euphoria, I could see why he'd splurged. Who needs a big house or fancy car when the world of information is yours to command? The moment the price came down to something more reasonable, everything else was going to be obsolete.

My "real" eye fell on Simons' coins, and I remembered the coin-collecting site. With the thought, my consciousness jumped back to it, then to its large-cents section. I wondered how well the inducer distinguished thought from command, and tested it by thinking of my own home page, which I really had no reason to visit. The headset read the distinction perfectly and remained encamped on the numismatist site. But when I got wondering about what might have happened in today's stock market, it jumped to a financial site, and I realized that part of the art of using it was ensuring that stray thoughts really were stray, and not subconscious desires. Lying to myself about such things might be harder than lying to the inducer. Cautiously, I thought about porn sites and was pleased to discover that my brain wasn't suddenly filled with images of naked women, or worse. I'd always *claimed* that such things disgusted me. Apparently they really did. What an intriguing therapeutic tool this thing would make, in the right hands, for those bold enough to risk communing directly with their subconscious. Then I thought of Traci and Michael and was horrified to find myself launching a search for old newspaper accounts of their deaths. Luckily, I was learning to react as fast as the Internet and yanked my attention away, landing, seemingly at random, on a weather site.

How interesting, a detached analytical side of me observed as the adrenaline subsided. Like a casual acquaintance uncomfortable with a real conversation, my subconscious had picked the weather as the safest diversion. Social programming, or something deeper? Not that it mattered. Perhaps directly communing with your subconscious wasn't such a good idea after all. Repression and denial aren't without their uses.

Could that be what happened to Simons? Maybe the headset had shown him something in his subconscious that convinced him he was a killer—and which he then decided to live out. No, that would have sent him hopping all over the Internet, like me, as the headset responded to a word-association trajectory that eventually led to murder. The log said he'd never left the coin-collecting site.

The inducer correctly read that as a command to return, and I again found myself faced with vast amounts of information on oversized copper pennies. But thanks to the headset, I was no longer overwhelmed.

Randomly, I picked up one of Simons' coins. It was from 1807, and without conscious effort I knew that there were six varieties, all readily distinguishable. I put the coin under the magnifying glass, mentally flipped through the list of options, and presto, I knew it was one of the more common varieties, worth $50

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to $200 depending on condition. I'd barely formed the question before I also knew that this coin was merely in "good" condition, and would fetch about $50.

It was stunningly easy. In something under a minute, I'd picked up an unknown coin and identified it. A great tool for a dealer, but was this something a collector really wanted? The headset had taken Simons' arcane hobby and turned it into something anyone could do. Some people wouldn't like that. It would leave them feeling diminished, deprived of a rare expertise. That, in turn, could fuel anger. But again, I was grasping at straws. What was the connection between the devaluation of Simons' hobby skills and his rampage against teen-agers? Not to mention that he'd deliberately brought the inducer into his hobby, knowing full well what would happen. Maybe his interest in the coins was the thrill of the hunt, not the time-consuming process of keying them out. That was how it had worked for me and stamps. I'd been hoping to find overlooked rarities, but I'd quit collecting because it was too much work to figure out what I had. I'd have viewed the inducer as a blessing.

My eyes returned to the desk, where I spotted the 1790s coin. Its front-and-center location made it likely that this was the last one Simons had been working on. It was also older than the 1807 penny, inherently more interesting.

The date was almost impossible to ascertain. What I saw was a very clear "179" followed by the top of a rounded digit. Earlier, I'd thought it was an "8." Now I wondered if it might be a "9." Thanks to the inducer, I knew it had to be one or the other. Large cents hadn't been made before 1793, so the worn digit wasn't a "0" or a "2," and "3" was ruled out by the fact that the earliest cents had a distinctively different design. There was no way it could be a "4," "5," "6," or "7."

I decided to start with "8." The Web blinked and with the briefest of delays told me that there were forty-six known varieties, ranging in price (for a coin in this condition) from virtually nothing to about $2,000.

It took only a couple of minutes to discover that even with the inducer, this hobby wasn't quite as easy as I'd thought. I couldn't hold forty-six design varieties in mind all at once, and even if I could, the coin was too badly worn. Starting with the cheapest variety, I went back and forth between my enhanced Web-vision and the magnifying glass, systematically ruling out one variety after another until eventually, I'd run through even the high-end-rarities and convinced myself that what I was holding was actually none-of-the-above.

By that time, my eyes were hurting again, and my back was feeling the strain of hunching over the magnifying glass. Glancing at a clock, I was startled to realize that I must have been staring at this one coin for the better part of half an hour. I couldn't imagine how long it would have taken the old-fashioned way.

I took off the headset, stretched my arms and shoulders, and did a few neck rolls, again regretting that I didn't have some tea or coffee. I was more baffled than ever. If this coin thing was so all-consuming for a newcomer like me, how could a dedicated hobbyist like Simons suddenly abandon it to dash next door searching for the gun? Surely he'd have at least finished with the 1790-whatever-it-was penny, then put it safely away.

I put the headset back on and returned to the Web. If not 1798, then it had to be 1799. The thought linked me to a new menu, and I found that there were only three varieties—and now the minimum value was $750, even for a worn coin like this one.

It wasn't even my coin, and I could feel my heart lurch. The dream of my childhood: a genuine *find*! Presuming I could figure out which variety it was.

Again, the obvious place to start was

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with the least expensive. Simons temporarily forgotten, I asked the Web for a list of identifying marks . . . and was suddenly struck by the foolishness of the whole endeavor. What was I doing, fiddling with coins when the world was afloat in evil?

With that thought came rage, flowing through me in an almost palpable wave. It was accompanied by a desperate need to do something, *now*, to rid the world of at least a small part of that evil. I was a bit vague on exactly what that meant, but playing with the damn inducer had nothing to do with it. What use were old coins, anyway?

I ripped off the headset and shoved my chair back from the desk so viciously that coins danced across the desktop. I ignored them. What caught my attention as I grabbed at the desk, barely in time to keep from toppling over backward, was Simons' abandoned wineglass, still two-thirds full of red liquid. *There* was one of the world's true evils. Simons drank and he'd shot kids. How could I not have seen that link before? The driver who'd killed Traci and Michael had been drinking wine, too—a couple of bottles of it from what the police later discovered.

I snatched the glass and hurled it against the wall, where the liquid splattered like blood across the faces peering at me from the photos. How fitting. *That* was the image I'd not wanted to face. But now, finally, I was ready to actually *do* something about it.

Traci had been flung nearly a hundred feet by the force of the impact, but Michael had been caught between the vehicle and the tree that had also killed the driver. Perhaps it would have been better if I'd insisted on viewing his poor, crushed body, but I'd acceded to well-meaning pleas that I not do so, that I remember him as he'd been, not as he'd become. The result was that my dreams were plagued by imaginings of how bad it might have been, dreams made worse by the fact that my work too often exposes me to the contents of other families' closed-coffin funerals, and I know how awful the carnage can be.

Now, my rage had a target. Maybe I couldn't rid the world of drunk drivers, but I could reduce their opportunities. Without really understanding how I'd gotten there, I found myself in the kitchen. The wine bottle smashed beautifully against the counter, though I barely managed to blink quickly enough to escape the shards from a rack of dishes I took out along with it. Something red and sticky was running down my arms. Wine? Blood? A mixture? I was beyond caring. I was on a mission—if not from God, then from Michael and Traci. Especially Michael. I flung open cabinets, looking for more booze, but Simons wasn't really much of a drinker. Had I seen anything in Delmoret's apartment? Nothing I could remember, but I'd not been looking. But wait, what about Jogbra? She'd been drinking well before mid-afternoon.

I dashed across the hall and rattled her door. Locked. I pounded on it and heard stirrings within, but she must have looked out the peephole because she didn't respond. I kicked hard, trying to break the door off its hinges, but I was wearing soft-soled shoes and all I succeeded in doing was bruising my foot.

The restaurant came to mind, with its bar and post-happy-hour patrons. Or better yet, there was a sports bar next to it—a rowdier hangout whose denizens were probably more thoroughly sloshed. But before taking them all on at once, I needed some kind of weapon. Might was well deal with Jogbra first. Especially because she might decide to call the police.

I dashed back into Simons' apartment and yanked open the patio door. The next-door patio was several feet away, separated by a nasty drop, but some kind of lintel or rooflet above one of the first-floor units provided a convenient foothold, and I was across in seconds.

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I didn't even test whether her patio door was locked. I stooped, grabbed a flowerpot, and hurled it through, following so close behind that glass was still falling as I entered the kitchen.

The apartment was a mirror image of Simons'. I found her in her living room, in the process of plucking a cordless phone from its cradle. All told, only a few seconds had passed since my abortive attempt to break down her door.

Somehow, I'd expected to find her guzzling an entire case of that designer beer, car keys in hand. Or perhaps dressed for a night of pub-crawling in the latest *Looking for Mr. Goodbar* fashions. Either way, I'd be the white knight charging to the rescue as I backed her into a corner and choked the life out of her so there would be one less person in the world who could ever harm someone else's family.

But she wasn't drinking, not even a cola. And instead of being dressed for a night out, she was wearing jeans and a T-shirt from something that called itself the Race to Stop Global Warming. Maybe the Jogbra hadn't been as much for show as I'd thought. A delicate chain suspended a tiny silver cross in the hollow of her throat. I could almost feel my thumbs pushing, right there, pressing more and more firmly until there came the crunch of a collapsing windpipe. On the far side of the room, the TV was tuned to an old movie. A comedy, from the sound of it.

The desire to act was as strong as ever. Just because she wasn't drinking and driving tonight didn't mean she wouldn't do so tomorrow or the day after. Better to prevent it now, before she had the chance.

A tiny piece of my mind was starting to realize that something was badly wrong with that logic. The man who killed my family was eight years dead. This terrified young woman had nothing to do with it. She'd have barely been out of her teens when it happened. But the need to act was as powerful as ever.

She was backing toward the corner, just as I'd envisioned in my fantasy. As she retreated, she transferred the phone to her left hand and plucked a heavy-looking sphere from an antique marble-topped table. The sphere was made of clear glass, but its center was opaque with something white, and I realized that it was one of those shake-it-up-and-it-snows-inside paperweights. It looked like something her grandmother should own, not her, and as I registered that thought, it occurred to me that maybe she'd inherited both the table and the paperweight from her grandmother.

The idea that Jogbra must have had a grandmother did nothing to dull my rage. But it did further convince that tiny corner of my rational mind that something was horribly wrong.

I realized that I was no longer advancing, that my arms and legs were locked in rigid tension. The tension simultaneously released a small fraction of the rage still boiling within me while holding me in place so that I was less likely to act on it. Trying to buy time, I devoted as much energy as I could to locking my muscles as tightly as possible. It was a delicate balance—a standoff against myself—and I hoped she didn't break it by suddenly chucking the paperweight at me. If she didn't manage to kill me or knock me out, I'd lose what little control I'd regained and be on her in a flash, as self-defense mutated into offense. Luckily, she seemed to have figured out that screaming, or even speaking to me, might also be counterproductive. The fight against myself required as much concentration as I could muster.

The tableau stretched for an interminable interlude that was probably only a few seconds. *I had to do something*. With an effort that felt like I was mired in tar, I lifted one foot microscopically and shuffled it backward. Her arm tensed and cocked, but nothing else happened. She herself had no more room to retreat.

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I shuffled the other foot backward. Six inches, no more. Another step, and then another. Enough to demonstrate intent to disengage. But the effort was too much; I couldn't keep it up. Every fiber in me still wanted to rush her, and the impulse was getting stronger, not weaker, as I retreated. Time to try something else. Fighting against an amazingly strong internal resistance, I closed my eyes. They popped right back open—reflex, wondering whether she'd take the opportunity to clobber me with the paperweight—but when there was no glass heading my way, I closed them again, and kept them closed.

My first attempt to speak was a wordless croak. Not exactly the most reassuring sound, even to myself. I tried again, and found that my tongue was indeed mine to command—and that it wouldn't rebel and scream imprecations at her about Traci and Michael.

"Call 911," I managed to get out. It was barely more than a whisper, so I devoted a bit more precious energy to speaking clearly. Years of psychology had drilled into in me the need to be calm and reassuring when talking to people in crisis, but for the moment, that was irrelevant. What I needed now was to communicate. "Tell them you have a madman in your living room who needs to be sedated. Then ask them to patch you through to Detective Morris from Central Precinct. Tell him that Adam Lamb knows what happened to Steve Simons."

I woke up in a hospital bed—under restraints, I discovered when I tried to scratch an itch on my left cheek. That discovery, of course, instantly converted a minor irritation into a fearsome prickling. I tried to rub it against the pillow, but that just made it worse. But it also helped bring me more fully back to consciousness. Even without an unquenchable itch, trapped isn't my favorite sensation.

"Welcome back," a familiar voice said. "Are you yourself again?"

I shifted my gaze and found Morris slouched in a faded-green chair. He looked tired. Behind him, a window revealed what looked like dawn. It had been dusk when last I'd seen the sky.

My memory felt like a loaf of raisin bread, without the raisins. I had the big picture, but details were missing. Luckily, Morris was looking for a big-picture answer. "If you're asking whether I'll try to kill you if you take off the restraints, the answer is 'no.'" As far as I could tell, my thought processes were normal—or as normal as could be expected, under the circumstances. Anger still burned within me, but at a controllable level, where *I*, not it, was the one who determined my actions. Of course, psychotics don't know they're psychotic, but I could remember behaving bizarrely, and that was a good sign.

"Good enough." He loosened one arm and then the other, but left my feet strapped down.

The itch proved to be a scabrous lump beneath some kind of slick bandage. "Stitches," Morris said. "Or more precisely, Superglue. They say you'll retain your good looks, such as they are. What the hell happened?"

I touched the bandage again. The raisins were returning, though not in chronological order. "Simons' dinner plate, I think." Either that or fragments of the wine bottle. The young woman hadn't actually hit me with the paperweight, had she? No, I remembered being conscious as the medic stuck me with the needle that finally released me from having to fight for control.

More raisins fell into place. Even before the police had swarmed her apartment, I'd been conquering the rage. The desire to rid the world of everything to do with alcohol was still there, but I'd been slowly gaining ascendancy over it. Somewhere during the seemingly endless wait for the authorities to arrive, it had crossed my mind that getting beaned with the paperweight was the

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least of my worries. If I wasn't careful, I was going to get shot when the police found me, especially if their arrival disrupted my still-precarious control. I'd tried to take a few more paces backward, but I was afraid of stumbling over something and losing myself again to the anger. Eventually, I hit on another solution: I sat down on the floor, then scooched backward until my spine bumped into a table leg. "Go," I'd said, and heard the rapid scurry of footsteps, followed by the thump of a door. I was still afraid to open my eyes—what if her grandmother had also given her a hutch of antique crystal wineglasses and those turned out to be the first things I saw?—but for the first time, I'd begun to believe the evening might have a happy ending. Then the police had burst in, but there'd been no reason to shoot me, and happily they hadn't.

Morris coughed. "I wasn't asking just about the cuts," he said. "But before you start, there's someone else who wants to know, too. She's been camped out here all night."

"*What?*"

"You don't have to talk to her if you don't want to. But I don't see much reason to keep her out of the loop, especially since you've already used her to relay a message to me. She insists she has a moral right to know what happened, and she does have a point. She also says she wants to know whether the next person to step into Simons' apartment is going to go off his nut, too. But I think she actually cares what happens to you." He paused for a moment, and for the first time in our long acquaintance, abandoned his dry, briefing-voice tone. "She was rather impressed by the way you restrained your episode—especially the bit about letting her get out the door." Another hesitation. "I was, too." His lips twitched. "I think she's afraid we're going to disappear you into a room with rubber hoses or something. I told her we don't do that anymore, but I'm not sure she believed me. I think this one really is the Boy Scout type."

I tried to grin, but it pulled oddly at the pasted-together pieces of my face. "Girl Scout," I said. Then the attempted grin faded. Simons had been the real thing, too.

Morris's dry tone returned. "The essence of political correctness is pretending you don't know the difference," he said.

This time, I grinned despite the Superglue. Morris was full of surprises today. Though come to think of it, I'd never gotten to know him well enough to know what, for him, "surprising" really was. He wore a wedding ring, so I presumed he was married, but for how long and to whom I'd never asked. Arms-length with the living—that had been my style. Yet apparently, he really had been worried about me.

"Sure, let her in," I said. Hopefully, I was well enough recovered to be coherent, though my memory still had gaps. "But before you do, maybe you should replace the restraints." I didn't feel like I was on the verge of doing anything rash, but there was no sense in scaring her any more than I already had.

"No need," said a voice from he door. "I trust the detective." I'd not seen the signal that had let her in, but the door had a large, wire-reinforced window, beyond which I could see two uniformed officers. People hospitalized for attempted murder can't expect much privacy.

She was still wearing the blue jeans and T-shirt, her hair pulled back in a ponytail that made her look even younger than the night before. I realized that I didn't know her name, but it didn't seem an appropriate time for introductions.

"So," Morris said, "what happened? By the time I got there, the ambulance crew already had you pretty well under, and you were mumbling a lot of nonsense. The only thing I got was that you wanted me to shut down that coin site, immediately."

The last of the raisins fell into place.

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"Did you?"

"Yeah. You were rather insistent, and I figured it couldn't hurt."

"Good." I paused. The pieces were back, but I needed to organize them. And however much it had receded, the rage was still there, making it hard to think straight. The lingering effects of whatever meds I'd been on didn't help either, though the latest generation of sedatives releases you with remarkable ease.

"Okay, I said. "Something from that website attacked me via the headset. I suppose you could call it a mind virus. Whatever it was, it was fast and powerful. All I know was that I was suddenly so filled with anger that I forgot everything else."

"So why did it cause Simons to go to the mall to shoot kids, while you trashed his apartment and attacked Ms. Jamison?"

So that was her name. "I don't think the virus is all that specific," I said, then paused, trying to recall the exact order of events. "It was more than just rage; I had a sense that the world was full of injustice."

Morris grunted. "Isn't it?"

"Sure, but I'm not talking about anything normal. I was suddenly the avenging angel out to cure—well, something. Whatever needed to be cured. I think that was as far as the virus went. We're probably lucky it didn't make Simons and me into terrorists and send us on bombing sprees."

Briefly, I glanced at Ms. Jamison, still standing in the doorway. "Well, it wasn't lucky for *you*." She might trust Morris to keep me restrained, but she was staying well out of reach, her arms protectively wrapped beneath her breasts. I wondered how much it cost her to be in the same room with me, how deeply her Girl Scout reflexes went, and how severely I'd wounded them. The tiny silver cross I'd seen the night before caught the glow filtering in from outside, but instead of being a magnet for murder, this time it made me wonder how much she and Simons had in common. All that do-unto-others stuff sounds naive, but it's psychologically sound. Ultimately, the experts say, forgiveness is something you do for yourself.

I turned back to Morris. "It's possible that a more sophisticated virus would have told me precisely what to do." I didn't have to add that someone might be creating such a thing, right now, as we talked. "This one left it to the victim to find a target. I bet Simons saw all those pictures on his wall and set out to protect his church kids from the ills of the world. Me, I've kind of got a history of . . . bad experiences . . . with alcohol." I turned my attention back to Ms. Jamison. "That's why I snapped at you on the patio yesterday afternoon. You didn't deserve it, and I apologize."

Morris pondered. "So you went after anything that had anything to do with alcohol, whether it was related to the death of your family or not."

From the corner of my eye, I saw Jamison's face jerk as my gaze snapped back to Morris.

"Yeah, I know about that," he said. "I figured that if you wanted to talk about it, you would, and if you didn't, you wouldn't. Anyway, you go on a crusade against alcohol, and Simons goes after kids?"

"Kids he sees as a bad influence, but yeah, that's basically the idea."

"So, two more questions. First, why is this thing hiding out only on some arcane coin-collecting website?"

I had to think about that one for a moment. "Well, there is a connection. Whoever designed the virus probably wants it to stay undetected, and that's not going to happen if he puts it on a site frequented by the whole world. He'd also want a site with relatively lax security. As for why the coin site? Well, inducers cost a lot of money, as do coins—particularly the one I was looking at when I got hit. And let me tell you, keying that one out without the inducer must be a

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real bitch. So it may be an arcane hobby, but I bet Simons isn't the only collector who either has an inducer or would love to have one. And who says it's only on the coin site? Personally, I'd check out unexplained killings by anyone who ever bought an inducer."

Morris said something I won't repeat. I'm sure he was thinking the same thing I was, that life had just gotten a lot more complex. There was no way a miracle gadget like the inducer wasn't going to find an ever-larger market, which meant the stakes had just gone up enormously in the computer-virus wars. Me, I don't care what kind of filters they start putting on those things, nothing would ever convince me to try one again. I'm sure Morris felt the same way. I may not always *like* being me, but I sure as hell don't want to become someone else.

"And your other question?"

"Oh, that one's hers," he said, nodding to Jamison.

"I just want to know why I'm alive," she said. "I mean, Steve really was the dearest, sweetest guy. I know you didn't believe me when I told you that before, but it's true. And, don't take it personally, but the first time I saw you, it was obvious that you have this edge to you that he didn't have. So why were *you* the one who was able to shut it off?"

That one, unfortunately, was easy: lots of practice thanks to all those years of denial and repression. But how do you tell a Girl Scout that her very kindness puts her at greater risk of succumbing to a mind-altering virus?

I decided to give her two answers. The first was a bald-faced lie. "Professional training," I said, knowing she'd believe it. Everyone thinks psychologists are better at holding our lives together than the average person. Actually, we're just people, like anyone else. Dear, sweet Steve hadn't had a chance, but that had nothing to do with professional expertise. With no experience repressing violent emotions, the virus must have hit him like a sledgehammer. Me, my entire life was built around repression and denial. When all was said and done, the virus had simply been more of the same. Life is ironic that way. Sometimes, the good is bad, the bad, good. Some people think that's part of what makes it interesting. I'm not so sure about that, but it might be why, even though it's been a while since I was a Presbyterian, at core I probably still believe in God.

The other answer was true. "It was also because you did everything perfectly." I might not have a lot of recent experience dealing with living, well-adjusted people, but that didn't mean I don't know what to say. Giving her the right words mattered, because she'd be replaying the past twenty-four hours for the rest of her life, just as I'd been replaying Traci and Michael.

And, irony of ironies, now that my inability to accept the loss of Traci and Michael had saved my life, maybe I could finally let them go. Stranger things have happened. There's nothing like having your mind taken over by an external force to make you realize how much control you've been giving to an internal one.

Maybe after the hospital discharged me—after I'd convinced Morris and the doctors and everyone else that the virus wouldn't suddenly rear up again—I'd try having dinner, or at least coffee, with a real, well-adjusted, living person. Not Jamison. I was a long way from being ready to contemplate a woman again, and besides, she needed me out of her life. Not to mention being too young. Maybe Morris. Maybe it was time to find out about his family. Maybe I could tell him about Traci's special smile or the way Michael loved squirrels and called them "squitchells." Or maybe not. Even sports chitchat would be a huge improvement over what I'd come to accept as normal. But it would definitely be coffee, not beer. I suspect I'll always be a teetotaler. Some things don't change. ■

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THE REFERENCE LIBRARY Tom Easton

Coyote Frontier, Allen Steele, Ace, $24.95, 357 pp. (ISBN: 0-441-01331-7).

Sword of Orion: Book One of Beneath Strange Skies, Sharon Lee and Steve Miller, Phobos Impact, $14.95, 288 pp. (ISBN: 0-9720026-5-5).

Grave Sight, Charlaine Harris, Berkley, $23.95, 262 pp. (ISBN: 0-425-20568-1).

The Final Key, Catherine Asaro, Tor, $25.95, 349 pp. (ISBN: 0-765-31353-7).

The Wave, Walter Mosley, Warner, $22.95, 209 pp. (ISBN: 0-446-53363-7).

The Plot to Save Socrates, Paul Levinson, Tor, $25.95, 271 pp. (ISBN: 0-765-30570-4).

Cyberchild, Alix Paultre, Zep Tepi Publishing (500 E. 63 St., Suite 22A, New York, NY 10021), $19.95, 383 pp. (ISBN: 1-4116-2661-3).

Numbers Don't Lie, Terry Bisson, Tachyon Publications, $14.95, 165 pp. (ISBN: 1-892391-32-5).

The Masque of Manana, Robert Sheckley, NESFA Press, $29, 573 pp. (ISBN: 1-88677-860-4).

Future Washington, Ernest Lilley, ed., Washington Science Fiction Association (10404 43rd Ave., Beltsville, MD 20705; www.wsfa.org), $16.95, 294 pp. (ISBN: 0-9621725-4-5).

Allen Steele's *Coyote* trilogy began with the idea that in the not-too-distant future, the US turned thoroughly into the night of the religious right, giving a Department of Internal Security the powers of East Germany's erstwhile *stasi* or the Soviet KGB and interning dissident intellectuals (DIs), meaning any scientist, university faculty member, or educated person who dared to question the party line. The tyrants said they had brought America back to its roots, its true self, but the Bill of Rights was no more and the Liberty Bell was no longer on public view, apparently for fear that it might inspire rebellion. But though the country was socially benighted, it remained a technical powerhouse. Starship *Alabama* was about to launch. However, the DIs managed to hijack it and settle the world of Coyote free of tyranny. And when the folks back home eventually sent more ships to bring the rebels back under the thumb, they licked 'em (see *Coyote Rising*, reviewed here in May 2005).

And now here's **Coyote Frontier**, which begins as Jonas Whittaker, a DI who missed the *Alabama*, is being taken for a ride to meet the head of Internal Security, who turns out to be an ally. He knows of Jonas's work on the theory that might someday make starbridges—shortcuts through hyperspace—possible, and he's offering to put Jonas in suspended animation until his theory can be made real.

You got it. It works, and in due time Jonas arrives at Coyote aboard a new starship, the *Columbus*, to install the bridge. By then the colony is having trouble because old equipment is wearing out. The colonists greet Jonas with mixed feelings, for they need equipment only Earth can provide. But Earth is deep into environmental collapse. It needs resources and even lebensraum. Can a treaty work? Can Coyote be protected from the depredations of capitalism, both homegrown and Earth-grown?

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Can it remain independent? Can its primitive natives be preserved? Or must Coyote go the way of Earth? And what happened to the very first starbridge ship, which went out to the Oort Cloud and vanished?

Many of the characters are familiar. Carlos Montero, no longer a wild kid or a charismatic rebel, is Coyote's president, who must lead the treaty negotiations. His daughter Susan is a naturalist studying the natives. Manny Castro, savant (AI robot), lives in the wilderness and avoids people, at least until Jon Parson, who deserts his post on the *Columbus* to go native, shows up. Lars Thompson is busily clear-cutting the forest, is perfectly happy to sell more lumber to new colonists, and thinks natives are just in the way. His son Hawk will eventually rebel against Lars and join Jon, Manny, and Susan in an attempt to protect Coyote.

And in the end . . . Steele does not disappoint. In this series, he expresses deep concern for the directions—political, ideological, economic, and environmental—in which we are moving today. He considers what we would have to do to resist or reverse the trends and concludes that drastic action is essential, as is great determination not to succumb to those forces that would undo any progress made. Success would be its own reward, but perhaps, if anyone is watching, there might be something more.

Yes, Steele leaves a hook at the end on which he might just be planning to hang a new novel, or even a trilogy. If you enjoyed the earlier books, you will find this one an entirely fitting conclusion, and you will be eager for whatever he comes up with next.

Sharon Lee and Steve Miller begin a new series, *Beneath Strange Skies*, with **Sword of Orion**. Some years past, a tyranny was defeated when two heroes pulled a stunt that made two opposing fleets vanish. First, however, they saw to it that their infant daughter was spirited away to safety. Now that daughter, Jerel, is a teen, and those who would revive the Old Order want to use her. She escapes kidnappers and flees with a friend, Kay, and her uncle Orned. Alas, Kay's mother yearns for the old days, and when she urges Kay to go with Jerel, the Canny Reader suspects she has sewed a locator beacon in his socks. That suspicion is never confirmed, but the bad guys don't seem to have much trouble zeroing in on the fleeing trio again and again.

Lee and Miller tell us why the bad guys want Jerel and they manage to keep her on the run until the final cliffhanger. There's no resolution, but this is Book One, remember? The chase will go on and on and on, until . . . Only the authors know the end of the tale.

Charlaine Harris's **Grave Sight** is an interesting blend of fantasy and crime. The protagonist, Harper, was struck by lightning as a child. Now she detects dead bodies and sees their last moments. And there's a living in this, for folks are willing to pay to find the missing and/or to learn what happened to them. Unfortunately, they don't always like what they hear, which is why Harper's stepbrother Tolliver travels with her as friend, companion, and bodyguard.

And so they come to Sarne, an Ozark town that has lost its old economic base and tried rather desperately to replace it with tourists. A boy has been found dead (suicide, say the cops), and his much lower-class girlfriend is missing. Not suicide, says Harper as soon as she looks, and then she finds the girl, shot in the back. Soon a local cop is asking her to check his late wife's grave. That, says Harper, was murder too, and perhaps it is just coincidence that the two dead women were sisters. But then their mother hears the news and says she must tell their fathers. And soon she's dead.

What's going on? I'm afraid I spotted

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the guilty party long before the author exposed that card (look for the most unctuous of the locals), but I still enjoyed the tale. Harris has a gift for deft description, entertaining characters and interactions, and convincing plotting. I'm looking forward to more by this writer.

The latest book in Catherine Asaro's saga of the Skolian Empire is **The Final Key**, following last year's *Schism*, in which Eldrinson rejected his children for going off to the Empire's military academy to become Jagernauts. Althor wound up apparently brain-dead and Eldrin (married to the Ruby Pharaoh) discovered a rather nasty drug in his search for something to control his empathic headaches, but Soz became a star student, rushing through the program in record time while also accumulating a record number of demerits. That's when Eldrinson shows up, ready at last for reconciliation.

It's also when Jagernauts start collapsing, their software somehow corrupted, the military leader, Kurj, goes into a coma, the Kyle Web that supports Skolian civilization starts unraveling, and the Traders, those evil slavers who love nothing better than to torture empaths and get off on pain, attack the heart of the empire with a massive fleet and even capture the ship bearing Roca, the kids' mother.

Soz, enjoying a quiet training gig on a battleship, is suddenly in the middle of a war, and she just may be the only one who can hold the Web together long enough to give Skolia a fighting chance. Meanwhile, Shannon, who yearns to join the Blue Dale Archers, gets his chance and discovers that they can apparently visit Kyle space in trance. But then another member of the family steps up to the plate and informs the reader that this book is not called "Part Two of Triad" because it's part of a trilogy (if it were, it should be Part Three—*Skyfall* and *Schism* both preceded it).

The tale starts slowly, for Asaro feels obliged to recap the background at some length, but it soon moves into high gear with some very satisfying action scenes. Characters develop in directions we expect if we recall earlier books in the saga. And the ending is warm and touching enough to soften the hearts of the most hardened readers. But there is a flaw: Asaro is a physicist with expertise in quantum theory, which provides her with some pretty convincing bafflegab. However, her bafflegab has rules that say some things are possible in the universe of her saga, and some things aren't. Part of the resolution here involves violating the rules, and when a character says that is impossible, Asaro says something like "Oh, well" and waves her magic wand.

At least she lets a character call her on it, which amounts to a sort of apology to the reader. A great many classic tales have done the same sort of thing without any sort of apology. And if it didn't hurt their success, it shouldn't hurt Asaro's. This one's an essential part of her canon, and if I seem too vague about the details, that's deliberate. Anything more specific might spoil your fun.

Walter Mosley is a writer of varied talents. He is responsible for the Easy Rawlins mysteries, and he has given young adults *47*, which brings SF tropes head-to-head with slavery. In adult SF, he has given us *Blue Light* and *Futureland*, and now **The Wave**, a thoroughly strange concoction that may impress non-SF readers more than SF readers.

The protagonist is Errol, whose father has been dead for years. One day he starts getting mysterious phone calls from someone who *says* he's Airy's dad. Now that just can't be, right? That's what Errol thinks, too, but he tracks the caller to the cemetery and finds a very strange fellow, GT (for the Good Times he says are coming), who bears an uncanny resemblance to Dad when he was

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young and knows an enormous amount of stuff about Errol's childhood. He also talks about the Wave, something that has been sweeping through the Earth until GT could rise "from the deep memory, replenished by the numberless, reminded, readied, and then released."

Thoroughly mysterious! It stays that way, too, until military agents kidnap Errol and GT and reveal the strange microorganisms—very reminiscent of Greg Bear's twenty-year-old *Blood Music*—that seem to create zombies and just may threaten all life on Earth. Or do they? Errol isn't so sure, for the officer in charge seems more than one card short of a full deck and GT has been pretty clear that his agenda, whatever it is, is not destructive, although he is certainly capable of self-defense. And soon after Errol escapes his captors, he meets the Wave itself and learns what side he is on.

This is the literary side of the genre. If your tastes lean that way, you will enjoy the tale. If they don't, it may give you the pip.

Paul Levinson's new novel is both very different from anything he has done before and very satisfying. **The Plot to Save Socrates** begins when Sierra, a graduate student, is shown a new Socratic dialogue by her elderly advisor, Thomas O'Leary. It's just a fragment, but it quite clearly describes a visitor who is trying to persuade Socrates to forego the hemlock and let a soulless clone die instead.

A clone? The visitor must be a time traveler, of course, and soon Sierra is looking at a photo of Thomas O'Leary that is well over a century old and shows him the same age she knows him as today. Before long, she is a time traveler herself, visiting Heron of Alexandria, who it seems hails from the further future, complete with the time machines, hidden in the attics of gentlemen's clubs, that everyone in the tale uses. She shares the dialogue with him, and he is off to do . . .

What? Though there is no clue to the identity of Socrates' visitor, there is soon no shortage of folks who seem eager to help him—or even force him—to live. Yet there also seem to be extra forces in play whose agendas are less certain, while the temporal paths of the characters—Sierra and her lover Alcibiades, Heron, Thomas, even William Henry Appleton, the famous publisher—entwine and tangle in interlocking circles that make Socrates' later observation that "Sometimes a circle is the best guide, especially if you want to know yourself" seem a welcome simplification. (Note that this line is close kin to one of Socrates' famous injunctions.)

So what's to know? Why was Socrates so prepared to die? Why should Sierra stay away from Alexandria? Who is Thomas O'Leary, really? Why does Levinson have the staff of the gentlemen's clubs, in London and New York and in several times, exclaiming over how the food is so much better now that they have a new chef? Why do certain members of those staffs seem extraordinarily long-lived?

The last two are never answered, but the new chefs are mentioned often enough that for much of the novel I was waiting to see Socrates—with perhaps a clone or two—take up a new career. That may have been a deliberate red herring, designed to keep readers from seeing what Levinson is really up to. Or perhaps the author just left in a couple of hints that he eventually chose not to fulfill as he pursued his chief characters through time and identity shifts enough to confuse even a philosopher.

This, I think, is the first of Levinson's novels to deserve to be called a *tour de force*. Watch for it on award ballots.

I met Alix Paultre at Albacon last October. He's an enthusiastic tech journalist who has tried his hand at SF with **Cyberchild**, with results that indicate that though he still has a ways to go—especially in his dialog—he already knows

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how to tell a pretty good story. The cast of characters begins with Gordona, a little girl in Gavrilova, an Eastern European hellhole (think Bosnia a few years back); her father is a leader of the local rebels who want independence for their province. Then there's Steve Dixon, a tech consultant who is steering one client—who wants to develop a computer to be constructed inside the brain by nanotech bots, without interference by bleeding hearts who think certain kinds of research should be regulated—towards setting up in Gavrilova. He's also hunting for a computer criminal who has released a virus that funnels tiny amounts from millions of victims into his pocket. Add in Eileen Harris, leader of the Non-Human Liberation Front, bleeding-heart animal rights extremists with an action arm that is not above violence, as they demonstrate when they get wind of the research being done in Gavrilova and decide to funnel funds and weapons to Gordona's dad. She, of course, must be on-site to supervise the destruction of the research facility and the slaughter of the researchers, and to get there she enlists the aid of Z-Man, a computer whiz and old friend of her own father.

Dixon learns that his hacker target is in Europe and homes in. Perhaps not surprisingly, he promptly bumps into Eileen and discovers attraction despite differences before he also bumps into his target and the chase is on, all the way to Gavrilova, where the bots are building their first brain-computer just as the raid brings everything to a halt. But Gordona's dad brings the ape with the nascent computer home, where it bleeds on Gordona before it dies. Soon the kid has a computer, complete with Web-access, and the industrialist who doesn't care for bleeding hearts is after her (as well as revenge on Eileen and her group).

The plot moves along very nicely. The defects are stiff and even monotonous dialog (the characters lack distinct voices), unsubtle characterization (to the point of caricature), and heavy reliance on coincidence (not that coincidence is a rare plot device!). As one might expect from a tech fan, Paultre sprinkles a vast array of gadgetry through his tale, most of it well based in what is coming out of the labs and only some of it actually superfluous to the story (he does like the occasional James Bond touch). If my words make you wonder whether the book is worth buying, go to http://www.smartalix.com and download a free copy.

This one's fun! Terry Bisson's **Numbers Don't Lie** presents the continuing tale (in three installments previously published in *Asimov's*) of a lackadaisical lawyer with a strange friend, one Wilson Wu, who is a mathematical wizard with a background in rock music, camel driving, aeronautics, law, meteorology, and a good deal more. Perhaps it is no wonder that they discover (in "The Hole in the Hole") a Volvos-only junkyard in Brooklyn, where a space-warp opens directly onto the surface of the Moon. What a great way to dispose of old tires! And a great way to salvage a rover, or a piece of one. "The Edge of the Universe" involves a kerosene-powered fax machine and a reversal in the flow of time that threatens both to reverse the expansion of the universe and to bring an incipient father-in-law, long known as a remarkable SOB, out of his thankfully terminal Alzheimer's. "Get Me to the Church on Time" concerns butterflies (moths, really) whose wing-flaps control hurricanes and connects the dots of an antique TV set, a cell phone hidden under a baggage carousel, a mad scientist, and a surprising lack of delay in making connections in and around New York. And everything is knitted together by Wu's woo-woo equations, which have been vetted for elegance (if not accuracy) by Rudy Rucker.

Bisson is famous for two things: He is reliably quirky, and he's a national trea-

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sure. Order this one now!

Robert Sheckley, renowned as one of SF's seminal writers, was the guest of honor at the 2005 World Science Fiction Convention held in Glasgow, Scotland. As is its wont, NESFA Press honored the occasion with a nicely produced volume of the GOH's work. **The Masque of Manana** presents forty-one of Sheckley's best short stories, including "Seventh Victim" (1953), which became the novel and film *The 10th Victim*. I have been known to express negative opinions of some of his later work, but I cannot deny the strengths Sheckley displays at his best, which amply justify his reputation for originality, cleverness, and humor.

This one's an essential part of the history of the field. Don't let it get by you.

"Will the Washington of tomorrow be a beacon of democracy, a monument to the adage about the dangers of absolute power, or a nearly forgotten footnote in humanity's history?" asks Ernest Lilley at the end of his introduction to **Future Washington**, just before he turns Steven Sawicki, Jack McDevitt, Brenda W. Clough, Kim Stanley Robinson, Ed Lerner, Joe Haldeman, Allen Steele, Cory Doctorow, and several more of SF's best and brightest loose on the question. One interesting answer is Brenda Clough's: ghost town, after midwestern realtors hatch a plot to scare everyone away from DC.

Have fun! ■

IN TIMES TO COME

In his earlier "InterstellarNet" stories here, Edward M. Lerner showed us a kind of interstellar contact more than a little different from what people usually imagine: a scenario in which civilizations born around different stars interact not face to face, but through "agents" dealing in, and created by, pure information. But what if that kind of relationship is eventually followed by face-to-face contact? You might think the prior exchanges would make it smoother and easier, but that isn't necessarily so—especially if extraterrestrial species are as different and devious as humans. Next month we begin serializing Lerner's new novel, *A New Order of Things*, about just that situation—which turns out to be full of not only surprises and dangers, but also memorable characters cast from several decidedly alien molds.

Catherine Shaffer's fact article, "The Terrestrial Search for Extraterrestrial Life," will help keep your imagination limber by examining the surprising diversity of alien lifeforms found in unlikely parts of our own planet, which gives us clues about how much wider the range might be elsewhere. We'll also have "The Scarlet Band," a new tale of Harry Turtledove's "geologically-based-Atlantis" alternate history (and incidentally a sort of Sherlock Holmes pastiche), and new stories by Rob Chilson, Jerry Oltion, and Geoffrey A. Landis.

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BRASS TACKS

Dear Dr. Schmidt:

It is always interesting when someone deeply enwebbed in a particular belief system fails to understand why someone else, similarly enwebbed in an opposing belief system, doesn't just let some things slide. I'm speaking of your puzzlement of why some pro-life pharmacists do not fill prescriptions for abortifacients (November 2005). You state that these pharmacists should just fill the prescriptions since a), it's the law of the land, and b), the abortifacients don't affect the pharmacists directly. This reasoning is naive and patronizing.

All members of American society have responsibilities that involve contextual interpretations of our laws. If we are faced with some situation where our actions will abet or directly cause someone's death, we must not carry out those actions, regardless of whether they are, by some dry reading of the law, legal. This is the situation that some ardent pro-life pharmacists face: they believe that their dispensation of abortifacients will soon lead to a human death. Thus, they cannot in their own good conscience carry out the requested prescriptions.

If you ran a gun or knife shop and a man came in one day, raving mad about how his wife had cheated on him and how he was going to kill her, you surely would not sell him the weapon to do so, would you? Even though, legally, you might be well within your "rights" to do so.

You may personally not believe that human life begins at conception, and you may favor some other definition of protected viability, but your belief is simply that: a belief. It is not provable scientifically. If we decide that human life can be defined legally via certain physiological or anatomical criteria, we are headed down a very slippery slope to euthanasia and eugenics.

As for the "diffuse tyranny" of Fundamentalism, I haven't seen such a good conspiracy theory since I last peeked in on the USENET UFO newsgroups.

Kevin Denelsbeck
Melbourne, FL

First of all, I did not mention abortifacients, but rather birth control pills, which are not the same thing. Second, my reasoning is nowhere as naïve and patronizing—or simplistic—as you make it out to be. You're welcome to argue with anything I say, but please do not put words in my mouth and attack me as if they were actually mine.

I did not express "puzzlement" about why these pharmacists refuse to fill the prescriptions, but rather examined the dangers of letting them place themselves above the law in that way. And I specifically acknowledged that the issue is not *morally simple, and referred to an earlier editorial, "Fundamental Dilemma," on that very subject. By the time you read this, that editorial should be available on my website, accessible through the "Links/Writers" section of the* Analog *website (analogsf.com).*

Furthermore, if we don't *define life legally, we're headed down a different slippery slope, with no way of providing*

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legal protection for any of it. And your definition of "conspiracy theory" is pretty slippery, too, if you think that has anything to do with what I wrote. I didn't say a thing about conspiracies, though I said quite a bit about a disturbing cultural trend—which is not at all the same thing.

Dear Dr. Schmidt,

You are wrong on this on two levels.

On the first level, there have been times and places in this country when it was morally and legally wrong to rent rooms in the same hotel to people of different races and there have been times when the opposite position prevailed. At the same time there were those who held the opposite moral view in spite of the law. If I understand you correctly, the hotel owner in the first case who thought it should not matter to which race a person belonged should have sold his hotel to somebody who thought it did matter and vice versa in the second case. On the surface, it would appear one or the other position must be wrong, or that it would be "the height of arrogance" not to agree with both positions at the appropriate time. I am arrogant enough to argue both are wrong.

On the second level, you say that "we can only be allowed to [do] whatever we want that does not restrict somebody else's freedom to do the same." but your editorial argues the opposite. The problem is not too little law, but too much. Nobody has the right to another man's labor if he chooses not to give it. That means that nobody should be able to require you to provide lodging, medicine, or education on his terms if you do not wish to provide it. To require it is to make you a slave, but the law requires it.

Now, you may be in favor of slavery. I know it still exists in most parts of the world, but I would not feel wrong in being against it even where it is legal.

I have no doubt that it appears cruel or unreasonable to the person who does not get what he wants because somebody else is not willing to provide it, but it is also cruel and unreasonable to demand that somebody either provide what he does not wish to provide or give up his career, go to jail, or worse.

Robert Peirce
Venetia, PA

You are wrong on at least two levels. In your first example, yes, there have been times when it was legally wrong and others when it was morally right—but if you think you can just substitute "morally" for "legally," you accept a lot more moral relativity than I can. And the suggestion that I "may be in favor of slavery" is too far-fetched to dignify with comment, as is your suggestion that expecting people to do a job they willingly took is slavery.

Dear Dr. Schmidt,

Tyranny might be becoming more diffuse, but your examples—public schools where teachers refuse to teach evolution and pharmacists who refuse to fill particular prescriptions, especially for birth control pills—do not support such a conclusion. These new, "diffuse tyrannies" are made possible by the old-fashioned, concentrated tyranny of government. The crucial question you fail to ask is why public school officials or pharmacists have a chokehold on goods and services that other people want to buy and sell to each other. Your article focuses primarily on pharmacists, and, in the interests of brevity, so will my reply.

You state that "You can't write or fill your own prescriptions." What you mean, of course, is that you can't legally do so. Although I am willing to take an even more radical stance, your issue with pharmacists relates only to the filling of prescription, not their writing. As such, why should pharmacists legally be allowed to come between a patient and a licensed physician? Why require the implicit approval of a second person with a special license when the approval of a first such person has already been obtained?

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It is true that even today, some pharmacists do more than simply move pills from large containers into small ones, but this fact only strengthens the freedom of conscience argument for the pharmacist. I will accept your point about freedom not being absolute, again, just to keep things short, but here it begins to work against your conclusion. The more that special skills, developed through considerable individual effort, are involved, the more that the freedom of the consumer to buy impinges on the freedom of the pharmacist to direct his own activities as he sees fit. Liberalizing the law regarding the filling of prescriptions would serve to allow pharmacists to practice freedom of conscience and give patients freedom of choice at the same time.

I leave the implications of this for education as an exercise for the reader.

Gordon G. Sollars
Kinnelon, NJ

Dear Dr. Schmidt,

I just finished rereading the novelette "Do Neanderthals Know?" by Robert J. Howe (December 2005). It is the best S.F. I have read in years. I liked the way the author tied in the story to the tree of knowledge in the Old Testament. My only regret is that it isn't really true!

Actually, the whole issue was a great pleasure—don't give up the politics! And the second installment of the serial "Sun of Suns" by Karl Schroeder cleared up some of my confusion left by the first part. I guess I should have held off reading it until I had the whole novel!

I have reading your magazine since I was nine years old and read my dad's subscription (under the name *Astounding*) and am on the cusp of my sixty-seventh birthday. Keep up the great work!

Jan Svetlik
Soap Lake, WA

Hi Stan,

I found the Alternate View about ball lightning (December 2005) quite interesting. One more data point: Nikola Tesla, the mad Serbian genius who invented much of today's electrical infrastructure, was able to produce ball lightning at his Colorado Springs high-voltage research laboratory in 1900. Tesla was obsessed by high voltages, high frequencies, and high power—his Colorado Springs laboratory generated 12 megavolts, at currents reported to be over a kiloamp. He considered ball lightning a fascinating nuisance, a byproduct rather than an intended result of his more important high-voltage researches, but he claimed to be able to produce it at will. But then, Tesla (especially in his later years) was rather mad, and given to claiming the wildest (and most unlikely) inventions, which no one ever saw working. He was very much the original of the mad scientist that has become a cliché of American iconography.

Geoffrey A. Landis ■

Continued from p. 89

Baxter was an avid SF reader as a child, but didn't attend a convention until he was an established pro. One of his early heroes was H. G. Wells, and Baxter's growing oeuvre includes sequels to two of Wells' novels: "First Men in the Moon," and "The Time Machine." He's also worked with BBC television, although, like many *Analog* readers, he feels that all too often, TV and movie people don't seem to have read any SF written since the Golden Age.

But that's not Baxter's fault. Each time he emerges from his creative Attic, he gives everybody in the field one more story they *should* read. ■

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UPCOMING EVENTS Anthony Lewis

3–5 March 2006
MARSCON 2006 (Twin City area SF conference) at Holiday Inn Select, Bloomington, MN. Theme: Things that go bump in the night. Guests: Dean Haglund, Paul Lawrence, Hugh S. Gregory. Registration: $42 until 31 January 2006, $55 at door. Info: http://marscon.org/2006/index.php; info06g@marscon.org; MarsCon, Box 21213, Eagan, MN 55121.

15–19 March 2006
27th INTERNATIONAL CONFERENCE ON THE FANTASTIC IN THE ARTS (Academic SF & fantasy conference) at Wyndham Fort Lauderdale Airport Hotel, Ft. Lauderdale, FL. Theme: Drawn by the Fantastic: Comics, Graphic Novels, Art, and Literature. Guest of Honor: Charles Vess. Guest Scholar: M. Thomas Inge. Special Guest Writer: Kathleen Ann Goonan. Permanent Special Guest: Brian Aldiss. Info: www.iafa.org

17–March 2006
LUNACON (New York area SF conference) at Hilton Hasbrouck Heights, Hasbrouck Heights, NJ. Guest of Honor: Jim Butcher. Artist Guest of Honor: David B. Mattingly. Fan Guest of Honor: Byron Connell. Costumer Guest of Honor: Lisa Ashton. Registration: $40 until 14 February 2006, $50 at door. Info: www.lunacon.org/lunacon2006/; info@lunacon.org; Lunacon 2006, PMB 234, 847A Second Ave, New York, NY 10017-2945.

23–26 March 2006
AGGIECON 37 (Texas SF conference) at Memorial Student Center, Texas A&M University, College Station, TX. Registration: $20 until 18 March 2006, $25 at door ($5 discount for students). Info: http://Agiecon.tamu.edu/; DeamonRyoko@yahoo.com; AggieCon, Cepheid Variable (958460), Box 5688, Aggieland Station, College Station, TX 77844-9081.

24–26 March 2006
COASTCON 29 (Gulf coast SF conference) at Treasure Bay Hotel, Biloxi, MS. Guests: Noel Neill, Ben Dunn, Deborah LeBlanc, Dave Arneson, New Voyages cast & crew. Registration: $30 in advance, $40 at door. Info: www.coastcon.org/CCWEB/CC29/cc29.html; coastcon_inc@yahoo.com; CoastCon, Box 1423, Biloxi, MS 39533.

24–26 March 2006
MIDSOUTHCON 24 (Middle South SF conference) at Memphis, TN. Guests of Honor: Glen Cook, David Weber. Artist Guest of Honor: Lubov. Media Guests of Honor: Regina Pancake, Christian Colquhoun. Filk Guest of Honor: Tom Smith. Registration: $30 until 1 March 2006, then $35. Info: www.midsouthcon.org; info@midsouthcon.org; Midsouthcon, Box 11446, Memphis, TN 38111-0446.

31 March–2 April 2006
AD ASTRA 2006 (Toronto area SF conference) at Crowne Plaza Toronto Don Valley Hotel, Toronto, Ontario, Canada. Guests of Honor: Ray Bradbury, Terry Brooks, Peter David, Ray Harryhausen, Betsy Mitchell, Rowena Morrill, David Warren. Registration: USD50/CAD50 until 28 February 2006, USD65/CAD65 at the door. Info: www.ad-astra.org; info@ad-astra.org; Ad Astra, Box 7276, Station A, Toronto, ON, Canada, M5W 1X9; +1.888.792.9367. ■

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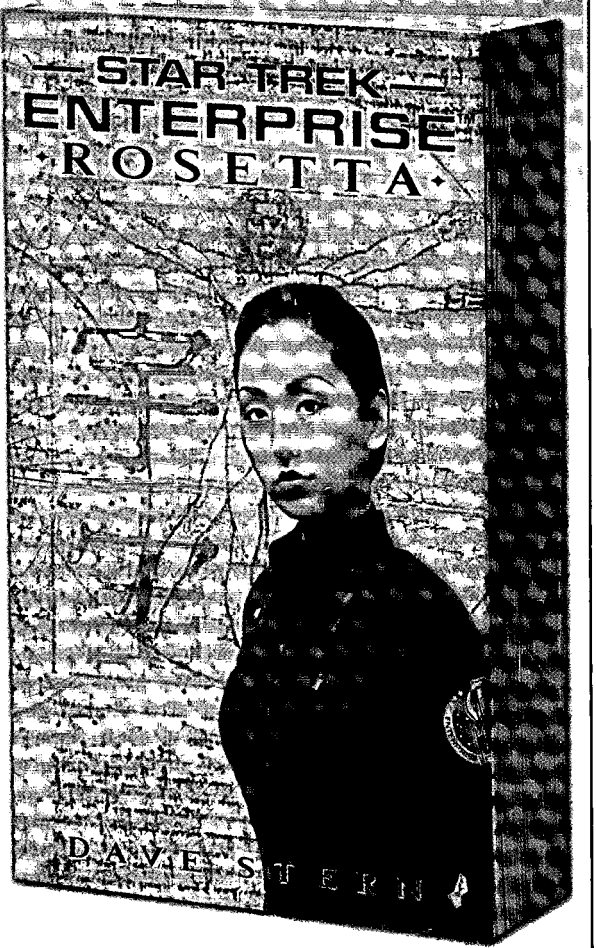

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